



2014

*A Strategic Plan to Manage the
Emerald Ash Borer in Simcoe County*



**THIS REPORT HAS BEEN
PREPARED FOR
THE COUNTY OF SIMCOE,
COUNTY FORESTS DEPARTMENT**

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PREFACE

This report was authored by Kenneth R. Marchant, Plant Health Consultant for use by The County of Simcoe (henceforth to be referred to as Simcoe County) in collaboration with Graeme Davis, Simcoe County Forester and staff. Its purpose is to provide the client with a summary of the status of the emerald ash borer (EAB) in North America, its expected outcomes and anticipated impacts on Simcoe County and its local municipalities and a range of options which could be employed by them to mitigate the impact of this destructive invasive alien insect pest.

DISCLAIMER

The information contained in this report has been compiled in part through:

- Personal interviews with research scientists, and regulatory, quarantine, communications and survey specialists in both Canada and the USA
- Communications with municipal foresters, professional arborists; and
- Reviews of literature, research papers, and media reports

The author has also relied extensively upon his hands-on experience and knowledge of the issue gained in his former capacity as EAB Lead Specialist for the Canadian Food Inspection Agency and as a private consultant on this issue.

The information and recommendations contained in this report are based on the most current scientific information and regulatory requirements as of January 1, 2014. While every effort has been made to ensure the accuracy of the information in this report, some of the content is based on personal recollections and opinions of the contributors and may not be entirely accurate.

This report, in its entirety or in part, and all opinions, products and processes expressed therein and first introduced to practice by the author (Kenneth R. Marchant) remain the intellectual property of the author and the client and should not be copied without their consent.

This report has been designed to meet the Terms of Reference specified by Simcoe County.

While considerable research has been conducted on EAB since it was first discovered in North America in 2002, there remains a paucity of information on its biology and other critical information and for this reason there needs to be some latitude with respect to predicting its impact and timelines, and as well, the overall effectiveness of any management options recommended to, and/or selected by the client.

ACKNOWLEDGEMENTS

I would like to thank the members of the Simcoe County forestry staff for their guidance and contributions to this report and to the numerous persons who have provided me with the information on which it is based.

In addition to the working group members, the author was required to consult extensively with scientists, regulatory and quarantine experts, municipal officials and numerous others involved in managing or regulating EAB in Canada and the United States. Their cooperation in providing me with the information to develop this report is greatly appreciated.

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EXECUTIVE SUMMARY

The Emerald Ash Borer (EAB), *Agrilus planipennis* Fairmaire, is considered to be one of the worst invasive alien forest pests to ever be introduced to North America. EAB has killed or infested, by some reports as many as 100 million ash trees since it was first detected in Michigan, and south-western Ontario in 2002; an estimated 10 billion ash trees in Canada and the US are at risk of imminent infestation and death. Both Canada and the US consider EAB to be a pest of quarantine significance. Slowing its spread and protecting the North American ash resource is a top priority for both countries.

Despite aggressive control, regulatory and communication measures aimed at slowing its spread, new populations continue to be found at numerous locations in both countries. These are often determined upon investigation to be the result of past human activities such as the movement of infested nursery stock and forest products (especially firewood).

As of February 1, 2014, EAB has been confirmed in much of southern, central and eastern Ontario including Ottawa, with disparate populations in Manitoulin Island, Sault Ste. Marie, and numerous locations in Québec, including the greater Montréal and Gatineau metropolitan areas. EAB was confirmed in Simcoe County (Bradford West Gwillimbury) in November of 2013 and movement restrictions were placed on infested properties by the CFIA. While most southern and central Ontario counties and regional municipalities are now included in a single, federally regulated area that encompasses all of southern Ontario including all communities in the Greater Toronto Area and the Niagara Region, Simcoe is currently excluded from this zone¹. Under the provisions of federal Plant Protection Regulations the movement of ash nursery stock and forest products, as well as all species of firewood from EAB regulated areas to Simcoe County is currently restricted. While there are no restrictions on the movement of these articles from Simcoe County at present (other than from those properties currently under quarantine), this will change as early as April 2014, with proposed changes to the policy by which the CFIA regulates EAB.

Over the past few years, there has been considerable progress made with respect to early detection and control of EAB. Despite this, the major obstacles to the effective management of EAB continue to be the difficulty of reliably detecting it at low population levels early in the infestation and as well, treating trees in woodland or forest settings.

¹ It has been announced by the CFIA that Simcoe County will be included in a greatly expanded regulated area that will include all areas of southern, eastern and Central Ontario effective April, 2014. Quarantines are currently in place on infested properties.

While several pest control products such as TreeAzin™ (a natural pest control product derived from the Neem tree), Acephate (ACECAP® 97), an organophosphate product, and Confidor 200SL (an imidacloprid formulation) have now been registered for use in Canada and can protect some trees from infestation, there are limitations on their effectiveness and it would be costly and unrealistic to treat large numbers of woodland trees.

While there is hope that biological control will at some point in the future bring EAB into balance, and both introduced and native species of biological control organisms are now successfully attacking EAB, it is unrealistic to expect that this will have an immediate impact on EAB populations.

The Canadian Food Inspection Agency (CFIA) is Canada's lead agency with respect to regulating or managing pests of quarantine significance such as EAB. Its current strategy is to slow-the-spread of EAB through movement restrictions, quarantines and other regulatory initiatives as well as public awareness.

Despite numerous requests from affected municipalities to the federal and provincial governments for financial assistance to mitigate the impact of EAB, none has been forthcoming. This position is unlikely to change.

This document provides a summary of the pest's history in North America, a forecast of its anticipated impact on Simcoe County and a range of feasible management options and their estimated costs and impacts, specific to Simcoe County and its local municipalities.

Assuming that EAB continues to infest and kill trees at its present rate, that biological control organisms do not emerge as a major control factor and that the current limitations on pesticide efficacy do not change, it can be expected that EAB will become pervasive throughout Simcoe County over the next 10 years and kill most of its ash trees over this period. While some of the management options listed in this document may delay the onset of widespread mortality somewhat, there is little that can be done at this time to prevent this from happening.

Since 2002, EAB has had major environmental and economic impacts on many urban communities which have been faced with the death of literally millions of ash trees; accordingly, those municipalities currently not known to be infested need to prepare for the imminent arrival of this serious pest.

The major impact on Simcoe County *per se* will be the loss of ash trees along its roadways and in some of its County forests (especially areas with high numbers of ash). While ash probably represents on average less than ten percent of the woodland

overstorey in the County, it is also important to note that this component can be significantly higher in some natural areas. Ash have been heavily planted as street and park trees in many of Simcoe's urbanized local municipalities. As well, they are commonly found in plantations and as shade trees on private properties throughout the County. It is uncertain at this time what impact EAB will have on future generations of ash but species diversity within affected woodlots, and genetic diversity within the genus itself will be greatly affected.

I. Simcoe County Responsibilities for Woodland Management

Simcoe County is an upper tier entity comprising 16 local municipalities including several which are highly urbanized. Under the Ontario Municipal Act, responsibilities for managing natural resources such as forests and woodlands are split between the County and its municipalities. Simcoe is responsible for managing its County forests, as well as ash trees along its County roads. Street and park trees in urbanized areas are the responsibility of the local municipalities. In addition to those woodlands, forest tracts and natural areas maintained by the County and its local municipalities, the Lake Simcoe, and Nottawasaga Valley Conservation Authorities are responsible for the management of some natural areas and work closely with the County on conservation issues.

Woodlands and natural areas on private properties are the responsibility of the property owner.

II. County Responsibilities for Urban Tree Management

While the County's primary responsibility vis-à-vis EAB is focused on managing County forests and woodlands under its direct control and on ash trees along its County roads, Simcoe Council has directed that options be investigated to more strategically and collaboratively manage the impacts of invasive alien species (IAS) with local municipalities (see also page 60). To that end, one of the stated objectives of this report is to provide a template for municipalities wishing to undertake management actions for EAB. As an appendix to this report, several management scenarios using examples from real-life situations have been included in Microsoft Excel format. These are intended to assist urbanized municipalities to cost out the various management options available to them and make an informed decision on how to manage local EAB infestations.

III. Summary of Possible EAB Management Options:

As an outcome of extensive analyses of EAB management programmes employed by EAB affected North American municipalities, three management options are available to Simcoe County and its local municipalities. These are outlined in detail within this report. A fourth option (**Aggressive Management**) sometimes considered for infested municipalities located well beyond what is considered to be the leading edge of the EAB infestation is not a practical alternative for Simcoe County or most other Ontario communities at this time due to survey and control limitations.

For comparison purposes, all options entail the replacement of removed trees with caliper sized, non-host trees consistent with current municipal urban forestry best management practices.

The Options are:

- Passive Management
- Active Management
- Proactive Management

1. **Passive Management:** This option treats ash trees the same as any other tree species and they would only be removed if they die or become hazardous. There would be no (or limited) surveys specific to EAB, no pesticide treatments of trees and limited public awareness activities. At the County level, there would be no replacement of ash removed along County roads or in County forests. However, for urbanized local municipalities, all street and park trees removed by the municipality would be replaced by caliper trees on a 1:1 basis, consistent with the municipality's best management urban forestry practices.

2. **Active Management:** The objective of this option is to preserve a percentage of the ash component of the canopy in urbanized municipalities of the County. To this end, the County, in cooperation with participating local municipalities would actively conduct surveys to detect pockets of infestation and prioritize areas for treatment and removal. There would be no actions taken by the County to preserve ash trees along County roads or in its forests. Participating local municipalities would have discretion over EAB management activities within their boundaries. All known infested ash trees within the boundaries of participating municipalities would be promptly removed. Apparently healthy trees not showing visible signs and symptoms would not be pre-emptively removed but would be assessed for possible treatment. To this end, local municipalities would develop rating criteria whereby candidate trees would be evaluated and prioritized for

possible treatment. Preference should be given to larger street and park trees in good condition and apparently free from EAB and where ash is the dominant species along roadways. It would not be practical or possible to treat all trees. Woodland trees cannot be cost effectively treated at this time. While this document only deals with publicly owned trees, the County or its local municipalities may elect to provide private property owners with information on protecting ash trees on their respective properties. Generally speaking, affected Ontario municipalities have not undertaken to pay for this.

Included as an appendix to this document are several examples of cost calculators (in Microsoft Excel format) developed by the author and based on real-life examples from Ontario municipalities. To accurately predict costs for treatment, removal and replacement of urban ash trees over a specified period, accurate information must be input into the model. Based on information compiled by many Ontario municipalities affected by EAB, it is often cheaper to treat healthy street and park trees in good condition over the initial 10 year period of an infestation than to cut them. This is especially true where the “true” value of a tree is taken into consideration.

- 3. *Proactive Management:*** This option is fundamentally the same as **Active Management** with the exception that ash trees which have not been identified for treatment would be removed pre-emptively regardless of health or condition. The objective of this option is to limit the long-term impact to the canopy and get replacement trees into the ground as soon as possible. The basic premise of this option is that most untreated ash trees will die over the next five to ten years and those in urban situations should be removed in a cost-efficient, planned manner irrespective of their infestation status, as soon as possible. To realize this, the County and participating municipality would conduct annual surveys to detect pockets of infestation in order to prioritize areas for treatment and/or removal. The pre-emptive removal of untreated trees would allow for some cost efficiencies and maximize opportunities for replanting and canopy recovery.

While the costs for implementing this option over a 10 year period are similar to those for **Active Management**, most of the cost is “front end loaded” because most untreated trees would be removed and replaced within the first five years. For this reason, this option is usually more expensive when viewed over the initial five year period. The primary benefit of this option is that it pre-emptively removes trees which are going to die in any event and allows for a head start on tree replacement and canopy retention/recovery. The drawbacks of this option are the aesthetic and environmental impacts associated with rapid canopy loss,

the difficulty in publicly defending the pre-emptive removal of seemingly healthy, symptomless trees and the up-front costs associated with this. For this reason, few Ontario municipalities have gone this route.

IV. Treatment of Trees with Registered Pest Control Products

Recent studies have concluded that treatment with pest control products such as TreeAzin™ is usually cheaper over a ten year period than taking no action, or pre-emptively removing all trees. When all the benefits that urban trees provide to a community are factored in (such as amelioration of water and air quality, wind and sound abatement, enhancement of real estate values, heat reduction and aesthetic considerations) researchers now believe that it is cost effective to treat trees for at least 15 to 20 years rather than removing them or letting them die. As the cost for treatment decreases (as has been the case over the past few years) it will be even more cost effective to treat than replace healthy trees.

V. Cost benefit of Slow-the-Spread Strategies for Simcoe County

“Slow-the-Spread” is a strategy often imposed by regulatory agencies such as the USDA or CFIA to slow the spread of pests of quarantine significance². With this strategy, there is a general acceptance that the pest cannot be eradicated and will continue to spread to suitable areas where it will be damaging. For slow-the-spread to be implemented as a regulatory strategy, there needs to be demonstrated merit in slowing the spread of the pest to new areas. This could include but is not necessarily limited to such factors as:

- buying time for biological controls to catch up with the pest
- protecting market access for exported products
- limiting economic losses
- environmental considerations

For slow-the-spread to work as a strategy there need to be regulations in place on the movement of potentially infested products such as nursery stock, firewood, timber or other forest products (in the case of wood vectored pests). In general, the authority to impose regulations of this nature rests at the federal, state or provincial level. Municipalities wishing to impose similar regulations at the municipal level are limited by

² See definitions

the Ontario Municipal Act, and would likely experience difficulty in developing and implementing these.

To date (February 01, 2014) Simcoe County is not regulated by the CFIA despite EAB being confirmed in Bradford West Gwillimbury in November of 2013, and there are no restrictions on the movement of ash trees and forest products from the County other than from known infested properties. However, the CFIA announced in 2013 that it plans to greatly increase the area regulated for EAB in eastern Canada, and that Simcoe and many other municipalities will soon be included in the regulated area irrespective of its infestation status. Ash forest products being moved from the County to areas of Canada and the US not currently regulated for EAB will have to meet strict movement restrictions. The amendments are expected to be implemented in April of 2014.

Despite EAB only having been detected in the Bradford area of Simcoe County to date, it is likely that it is established at other locations in the County and will be detected in the near future. For this reason, there is no anticipated benefit to be realized by the County or its municipalities in attempting to limit the further introduction and intracounty spread of EAB in the future³.

VI. Preparedness

Simcoe County is seemingly well prepared for the financial and environmental impacts EAB will have locally.

- Policies have been developed to deal with the large number of dead roadside trees anticipated as a result of EAB and the risk associated with firewood movement
- County staff have been in close consultation with local municipality officials and workshops have been held to educate those involved with the issue
- Communication Plans are being developed to assist the public in understanding the impact EAB will have locally
- Policies have already been enacted to deal with the risk posed by dead trees along trails within Simcoe County forests
- Capacity at Simcoe's disposal sites has been reviewed with respect to the anticipated increased flow of wood products to these and policies have been developed to reduce the risk of further spread through the movement of EAB infested wood products from these.

³ EAB cannot usually be detected for at least 4 years after its initial introduction to an area and during this time it is likely to disperse well beyond the area of introduction. By virtue of comparisons with neighbouring municipalities, EAB is likely to have already been introduced to numerous sites in the County with shipments of nursery stock, firewood and other infested forest products.

VII Recommended Action Plan- Simcoe County and Local Municipalities

Objective	Action	Responsible	Comments
Quantify ash population and assess risk	<p>Ash Tree Inventory</p> <ul style="list-style-type: none"> • Roadside • Urban (street and park) • Hazard trees in County Forests or municipal woodlands 	<ul style="list-style-type: none"> ➤ Simcoe County ➤ Municipal Forestry staff 	<p>Accurate inventory information is essential for accurate costing of treatment and removal actions. <i>Simcoe County has completed a preliminary roadside survey-(January, 2014)</i></p>
Determine presence of EAB	<p>Survey</p> <ul style="list-style-type: none"> • Detection surveys • Delimitation Surveys around known infestations 	<ul style="list-style-type: none"> ➤ Simcoe County ➤ Municipal Forestry staff 	<p>Surveys are integral to sound EAB management programmes... good survey info will allow management activities to be targeted and allow for some urban trees to be saved.</p> <p><i>Simcoe plans to conduct detection surveys for the next 5 years (2014-18)</i></p>
Evaluate potential for treatment programs	<ul style="list-style-type: none"> • Tree Inventory • Develop Tree Assessment Criteria • Cost comparison of potential options at municipal level 	<ul style="list-style-type: none"> ➤ Simcoe County ➤ Municipal Forestry staff 	<p>It is possible to cost effectively save urban street and park trees if treatments are begun early enough</p> <p><i>Simcoe has no plans at present to treat or replace roadside trees or those within County forests</i></p>
Public and Internal Awareness	<p>Communications and Outreach Initiatives</p> <ul style="list-style-type: none"> • Develop Communications plan at County and municipal levels • Designate spokesperson • Media lines • Internal briefings to Councils • Preparation of presentation 		<p>Public support is essential for treatment programmes to be successful. Also, councils need to be apprised of the facts re: EAB and the true impact of infestations</p> <p><i>Simcoe is in the process of developing a communications plan which calls for open houses and the production of communications materials (January, 2014)</i></p>

	<p>materials (PPTs etc)</p> <ul style="list-style-type: none"> • Workshops, open houses and other information exchange forums • Preparation of literature for affected property owners • Website info 		
Preparedness	<ul style="list-style-type: none"> • Briefing of Municipal Councils etc. • Accurately cost out management options • Alert councils etc. to non-discretionary costs associated with EAB 		<p>See above</p> <p><i>The EAB Strategic Management Plan will fulfill this objective</i></p>
Assistance to Private land owners	<p>Evaluate potential for such elements as:</p> <ul style="list-style-type: none"> • tree-replacement programmes • woodlot management • salvage logging etc. 		<p>In general, municipalities have not provided financial assistance to affected landowners. Some have assisted, however, with providing information on remediation and salvage activities.</p> <p><i>Simcoe has no plans to financially assist property owners or others affected by EAB</i></p>

DEFINITIONS

Cambium/Cambial Layer

A layer of cells that forms tissues that carry water and nutrients throughout the plant. On its outer surface, the vascular cambium forms new layers of phloem, and on its inner surface, new layers of xylem (see definitions).

Canadian Food Inspection Agency (CFIA)

A Canadian Federal agency reporting directly to the Federal Minister of Agriculture and Food and responsible for: Food Safety, Animal Health and Plant Health (Quarantine) in Canada. Under the Canadian Food Inspection Agency Act (1997), the CFIA is Canada's National Plant Protection Organization as defined by the United Nations and is the lead agency with respect to excluding, eradicating or otherwise managing pests of quarantine significance. As well it certifies exports of agricultural and forest product for freedom from injurious and/or quarantine pests.

Disparate/Disjunct Populations

With respect to Simcoe County's EAB Management Plan these terms refer to populations which are separate from the general contiguous population of EAB. These are often the result of the introduction of EAB to a new area through natural dispersal or human activities (**see Outlier**).

D-03-08

Refers to CFIA Policy Memorandum D-03-08: "Phytosanitary Requirements to Prevent the Introduction into and Spread Within Canada of the Emerald Ash Borer, *Agilus planipennis* (Fairmaire)" <http://www.inspection.gc.ca/english/plaveq/protect/dir/d-03-08e.shtml>

Endemic

Endemic means native to, or confined to an area. It can also include long established (naturalized) organisms which are now considered part of the local flora and fauna.

Epicormic Shoots

Shoots generally produced along the trunk or main branches of a tree, often as a response to an injury or damage to the underlying tissues. These are often long and vigorous.

Extirpated

Refers to an organism that no longer exists (extinct) in an area where it formerly occurred, but is still present (extant) in other areas.

Invasive Alien Species (IAS)

IAS are organisms which originate elsewhere and are not native to the area. Human involvement is implied in their introduction to the new area (either deliberate or accidental) and there generally has to be (the potential for) economic or environmental harm before they can be classified as IAS. This term is generally synonymous with and used in place of such words as: "exotic", "foreign" or, "introduced and established" although most exotic organisms would not qualify as IAS, because they have minimal economic or environmental impacts.

Natural Resources Canada-Canadian Forest Service (CFS)

Better known as the “CFS”, this Canadian government department is responsible for conducting research on forest pests (as well as numerous other forestry related concerns). The CFS has been instrumental in conducting leading edge research on EAB and providing insightful science-based advice to the CFIA and other partners.

Nested Quarantine

This is a quarantined area, established within a larger quarantined area (or zone). It is considered a highly beneficial strategy for slowing the spread of pests of quarantine significance such as EAB, especially where they are difficult to detect in the early stages of infestation, and as well, protecting adjacent counties and municipalities not believed to be infested.

Non-Host Species

Extensive research conducted in North America has confirmed that the biotype of EAB present in North America attacks only true ash (genus *Fraxinus*). All other species of trees are termed non-host species as they will not support any life stage of EAB.

Outlier

With specific reference to invasive alien species such as EAB, an outlier is a population disjunct from a generally infested area. It is usually considered the result of an introduction event from an infested area through the movement of infested forest products such as firewood but can be the result of natural dispersal (**see Disjunct**).

Parasitoid/Parasitoidism

A **parasitoid** is an organism (usually an insect) that spends a significant portion of its life cycle attached to, or within a single host organism but which it ultimately consumes and kills in the process.

Phloem

This is the tissue in a plant responsible for the active conduction of water, nutrients and metabolites throughout the plant and along with the **xylem** comprises the vascular area of the plant.

Pest of Quarantine Significance

This is a plant pest considered by virtue of pest risk assessments or past history, to pose a major economic or environmental risk to a geo-political entity (e.g., country, province or state). To be defined as such, there must be science-based evidence that the pest poses a risk to the importing country. Under the terms of the International Plant Protection Convention (United Nations), countries are not permitted to use non-quarantine pests as non-tariff trade barriers and must provide documented, science-based evidence that an organism is a pest of quarantine significance or, face stiff penalties in the event of a challenge by an importing, or competitor country. Countries are legally obligated to eradicate or prevent the domestic spread of pests of quarantine significance where these are present in their country.

Pest Risk Assessment (PRA)

PRA is the science based analysis of the potential of an organism to become a pest species. The assessment examines factors such as host and climatic suitability, pathways, vectors and potential environmental, ecological and environmental impacts. Potential pests are usually evaluated within a logic matrix and numerical scores are assigned to the pest permitting it to be ranked and compared to other potential pests. Canada and other developed countries use PRA as a decision making tool with respect to regulating potential pests or the commodities and pathways by which they could be introduced.

Quarantine Zone

See Regulated Area.

Regulated Area

With specific respect to Simcoe County's EAB Management Plan, **Regulated Area** refers to areas of Canada regulated under Federal Plant Protection Regulations. Under these, regulated areas are quarantined with respect to the movement of the pest and articles such as ash forest products, nursery stock and firewood which have all been determined to be vectors of EAB.

Trap Trees

Ash trees which are girdled by regulatory officials prior to the EAB flight season in order to stress them and make them more attractive to EAB adults. They are destructively sampled (cut and peeled) at the end of the growing season and analyzed.

UFORE

UFORE is an acronym for "Urban Forest Effects" and refers to a computer model developed by the USDA-Forest Service (see below) that calculates the structure, environmental effects and values of urban forests. Software is now in the public domain. Further information can be obtained at: <http://nrs.fs.fed.us/tools/ufore/> or www.ufore.org/UFORE_manual.doc

United States Department of Agriculture (USDA)

The USDA (in part) is the US counterpart to both the CFIA and CFS. APHIS (the Animal and Plant Health Inspection Service) is responsible for designing and enforcing import, export and domestic regulatory programmes to exclude or limit the spread of pests of quarantine significance such as EAB, while the Forest Service (USDA-FS) conducts research into the management of forests pests including those of pest significance such as EAB).

Xylem

This refers to the supporting and water conducting tissue of vascular plants, consisting primarily of tracheids and vessels. It is generally woody tissue. The **xylem** and the **phloem** comprise the vascular region of the plant and are responsible for the movement of water and nutrients within the plant.

1.0 INTRODUCTION AND BACKGROUND

1.1 Discovery of Emerald Ash Borer in North America

The emerald ash borer (EAB) was first confirmed in North America in July of 2002, after it was found in declining trees in the Detroit, Michigan area exhibiting “disease” symptoms. Prior to this, EAB was essentially unknown to the western world and had not been considered by Plant Quarantine experts to be a high risk species for entry to North America. A follow-up survey by US state and federal authorities confirmed EAB to be present at numerous sites in the greater Detroit area. It was also officially confirmed to be in the Windsor area of Canada by the CFIA in August of 2002, where it had apparently been present for many years and was now killing trees. In the summer of 2002, a pest risk assessment (PRA) conducted by the CFIA, concluded that EAB would likely be a serious and damaging pest of quarantine significance in North America.

1.2 Dispersal and Establishment

At the time of its discovery in North America EAB was already well established. Research has confirmed that it arrived in the Detroit area of Michigan in the early 1990s, probably with infested packaging and crating materials from China. The role that human activities played in the spread of EAB was not fully appreciated at that time and there is now evidence that it was already well established by 2002 at numerous locations throughout the mid-western US and Ontario.

While EAB adults can fly well and will disperse naturally, much of its distribution within North America can be directly attributed to the movement of ash nursery stock and forest products, especially firewood. It is important to note that it may take as long as five years after it has been introduced to an area before signs and symptoms are manifested in the tree (which greatly limits the effectiveness of any control actions which may be taken against it). Early (and timely) detection remains the bane of EAB management. Many outliers in Canada and the US have been confirmed to have been established long before quarantines and other control measures were enacted by either country and more are being reported weekly. As many as 100 million ash trees are now estimated by authorities to have been killed or infested in North America since 2002, with 9-10 billion trees at risk.

1.3 Hosts

Research has confirmed that while EAB attacks other genera of trees in Asia including elms and walnuts, only ash (*Fraxinus* spp.) are attacked in North America. While all North American ash species are considered to be susceptible, the blue ash (*Fraxinus quadrangulata*), a rare species in the wild in Canada but often planted as an ornamental, is considerably more resistant to attack and is surviving in some EAB infested areas of south-western Ontario. Of particular concern in Ontario is the fate of the pumpkin ash (*F. profunda*), an extremely rare Carolinian species only confirmed to be present in Canada in the early 1990s (and not believed to naturally occur in Simcoe). While some seedlings are surviving in some Windsor area woodlands, mortality in Ontario pumpkin ash stands is now approaching 100 percent and there is concern that this species may be extirpated from Canada in the very near future with its inherent genetic diversity lost forever. The European ash (*F. excelsior*), commonly planted in urban areas of eastern Canada, is also susceptible to EAB attack. Asian species such as the Manchurian ash (*F. mandshurica*), which are sometimes planted in Canada and have been crossed with native species to produce ornamental cultivars, have co-evolved with EAB and are relatively resistant to attack when planted in North America. Unfortunately, all hybrids currently in use are very susceptible to EAB.

1.4 Distribution in North America

As of January, 2014, EAB now generally infests much of southern, central and eastern Ontario where most ash trees are now dead or dying (see *Figure: 1*). *Localized*, but expanding infestations are now present at numerous locations in Ontario and Québec; presumably the result of human activities and natural dispersal around introduction sites (outliers). Many of these are deemed by the CFIA to be generally infested for regulatory purposes.

EAB was confirmed in the Toronto area in the fall of 2007, and in York, Brampton, Mississauga, Oakville and several other areas around the GTA in 2008. In 2009, EAB was found in Hamilton, (at several locations), St. Catharines and Welland, Ontario. In 2010 many new counties and municipalities in Ontario and Québec were determined to be infested. EAB was detected in the Bradford West Gwillimbury area of Simcoe County in November of 2013 and Simcoe County is deemed to be infested. With the continuous discovery of EAB at numerous sites across Ontario it is apparent that EAB is now well established throughout much of southern, central and eastern Ontario.

Despite aggressive control measures State and Federal quarantines, and public relations blitzes, EAB continues to be found in new areas of the US on a regular basis and now infests much of the central and eastern areas of the country (see *Figure: 2*).

The States of Colorado, Kansas, and Georgia have recently been added to the list of infested areas. As a result of this, US regulatory officials amended their federal quarantine in 2012 to allow for the interstate movement of regulated ash materials between contiguously infested states.

As in Canada, most of the new infestations are attributed to past human activities such as the movement of infested firewood and forest products, and natural dispersal around these.

1.5 North American Distribution of Some Common Ash Species

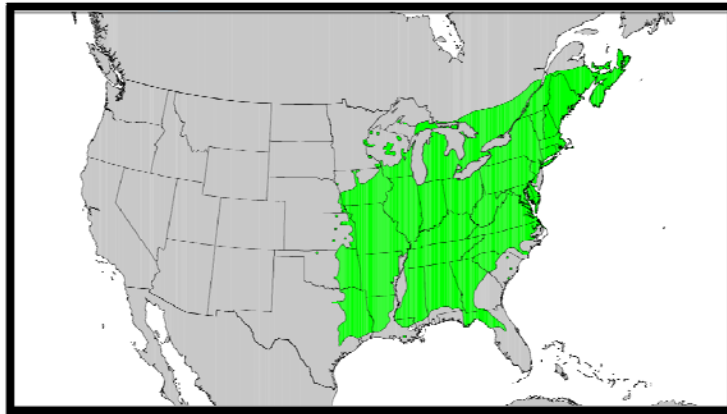


Figure 3: North American Range of White Ash (*Fraxinus americana*)⁴

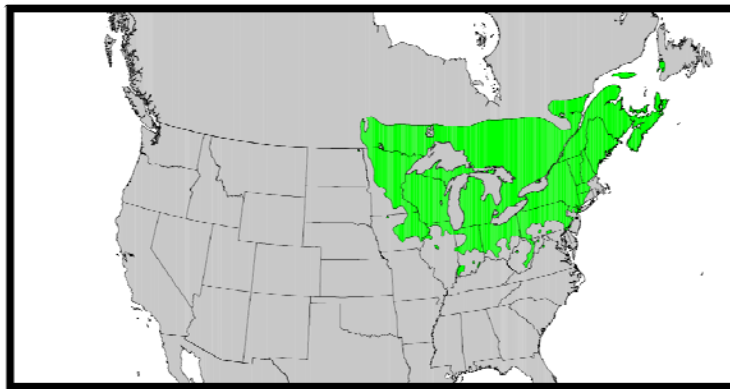


Figure 4: North American Range of Black Ash (*Fraxinus nigra*)

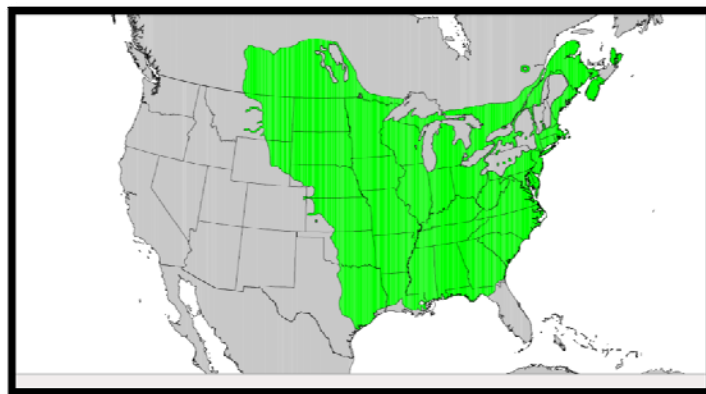


Figure 5: North American Range of Red (a.k.a. Green) ash (*Fraxinus pennsylvanica*)

⁴ Figures 3,4, and 5 Courtesy of USDA-FS

2.0 REGULATORY AUTHORITY AND RESPONSIBILITY

2.1 Canadian Food Inspection Agency

Canada is a signatory to several international treaties such as the International Plant Protection Convention (IPPC) under which it is required to report, monitor and take appropriate actions against pests of quarantine significance such as EAB. Failure to do so could result in trade sanctions being taken against Canada, loss of access to markets for agricultural and forestry products, and other penalties.

2.1.1 Legislative Authority

Under the Canadian Food Inspection Agency Act, the Canadian Food Inspection Agency (CFIA) has been designated Canada's official national plant protection (and quarantine) organization and is the lead agency in Canada with respect to developing regulatory policies for forest and agricultural pests of quarantine significance such as EAB. The CFIA is empowered under the Plant Protection Act (PPA) and Regulations which give it the authority to enact and enforce regulations and policies to protect Canada's agricultural and forestry production base, environment and natural resources and to take all necessary actions to exclude, eradicate or otherwise manage invasive pests of quarantine significance. To this end, the CFIA works in close cooperation with other Canadian federal and provincial government partners, foreign government agencies such as the United States Department of Agriculture (USDA), and industry stakeholders to develop science-based import, export and domestic movement regulations, and as well, inspection, surveillance and suppression strategies for EAB and other quarantine pests.

2.1.2 Quarantines and Movement Restrictions

The CFIA has considerable authority under the PPA to manage invasive alien pests. Under the Act it can:

- Impose quarantines on areas believed to be infested with a pest of quarantine significance
- Place movement restrictions on properties, regulated commodities and conveyances
- Enter onto private property without having to obtain a warrant for the purpose of survey, inspection and control actions (such as tree removal)
- Undertake control actions for pests of quarantine significance
- Order:
 - The destruction of infested "things"
 - The treatment of suspected infested things, premises and lands

Areas can be designated under a federal Ministerial Order (MO) as regulated for a pest. This obviates the requirement for CFIA inspectors to issue individual notices to

numerous individual property owners in large regulated areas. MOs are usually issued on defined geo-political areas with defined boundaries such as counties or municipalities.

Under the PPA and Regulations, the CFIA can also issue:

- Notice of Infested Place
- Notice of Prohibition of Movement
- Notice of Quarantine

While each document is issued under different sections of the Act/Regulations they allow the CFIA to prevent the movement of suspected infested commodities from a property and can be very effective in slowing the spread of invasive species.

In support of its regulatory actions, the CFIA often defines and promulgates policy by way of directives referred to as “D”-Memos. According, D-03-08: “Phytosanitary Requirements to Prevent the Introduction Into and Spread Within Canada of the Emerald Ash Borer, *Agrilus planipennis* (Fairmaire)” was issued by the CFIA in 2003. This document provides a basis for the regulation of EAB and explains CFIA policies in place to prevent its introduction into and domestic spread within Canada. Since 2002, this document has been amended several times to reflect up-to-date research, amended regulatory policies and industry certification quality management plans. It is available at: <http://www.inspection.gc.ca/plants/plant-protection/directives/forestry/d-03-08/eng/1323821135864/1323821347324>

The document was last amended March 19, 2012.

2.1.3 Administrative Monetary Penalties (AMPS)

CFIA inspectors also have the authority to issue fines under the authority of the Agriculture and Agri-Food Administrative Monetary Penalties Act (S.C. 1995, c. 40) to persons caught violating the Plant Protection Act or its Regulations. These are referred to as Administrative Monetary Penalties (AMPS). For the most part, the issuance of these was restricted to persons bringing firewood from EAB regulated areas to non-infested areas such as parks and campgrounds.

2.1.4 Prosecution

The CFIA has the authority to prosecute under the PPA/Regulations. Under section 48(1), penalties can range up to a \$50,000 fine and/or six months imprisonment for summary convictions and up to \$250,000 fine and/or imprisonment for up to two years for an indictable offence. Prosecution is usually reserved for flagrant and/or repeat violations of the PPA and is rarely used by the CFIA

2.2 Provincial Governments

In Canada, provincial governments are responsible under section 92A of the British North America Act for the management of natural resources such as woodlands and forests, as well as environmental protection. Additionally they must approve the use of federally registered pesticides (Ontario). While provincial statutes are not permitted to contradict or limit federal legislation, provinces have the authority to enact laws to strengthen or otherwise augment federal acts and regulations where they see the need.

In Ontario, the Ontario Ministry of Natural Resources (OMNR) has taken a major, albeit non-regulatory role in combating EAB. With specific reference to EAB, they have provided in-kind assistance in training CFIA inspectors (and others) on detection and surveys, sponsoring and overseeing scientific research, and with public education and awareness initiatives. OMNR biologists sit on several EAB advisory panels which have provided advice to the CFIA on policy development, research prioritization and regulatory issues. The OMNR Parks Section has been a key partner in limiting the spread of EAB to provincial parks and campgrounds through pre-screening campers, imposing restrictions on firewood movement and educational activities.

In 2003, the OMNR provided an estimated \$1 million for Conservation Authorities (CAs) in south-western Ontario to plant non-host trees in areas devastated by EAB. While this initiative was widely seen as a success in mitigating the impact of EAB, assistance has not been offered in recent years to similarly affected areas due to budget constraints.

In 2012, the Invasive Species Centre (ISC) located in Sault Ste. Marie announced it would assist affected municipalities in developing EAB response plans. To this end, multidisciplinary consultation groups were established by the ISC and several meetings conducted during 2013 to develop, and coordinate response initiatives at the urban level.

2.3 Municipalities

Municipalities (towns and cities) are responsible for managing their respective urban forests and generally receive little or no assistance from the federal or provincial levels of government for this. Urban forests can include: street trees, urban woodlands, parks, cemeteries and other natural areas and in eastern Canada may contain a large percentage of ash species.

Many urbanized areas of Ontario and Québec have a multi-tiered municipal structure, with municipalities often sharing responsibilities for the management of woodlands, natural areas and roadside trees with the County, Regional Municipality or MRC (Québec) in which they are situated. Urban forests are not managed on a consistent

basis and the degree of internal cooperation with respect to dealing with EAB and other forest pest issues varies considerably from municipality to municipality. For instance, many urbanized counties and regional municipalities do not have a regional forester and leave it up to their constituent (local) municipalities to manage their respective urban forests.

Municipalities in Ontario have the right, under the Ontario Municipal Act to pass by-laws to protect their urban forests and deal with such issues as dead trees on private property which may pose a hazard. In recent years, many municipalities have been faced with the dilemma of removing many of thousands of dead ash trees killed by EAB. Ash trees often rot at the base soon after death and become a serious hazard. To that end virtually all major municipalities in Ontario have property standards by-laws that compel property owners to remove hazardous trees and provide the right for municipal inspectors to enter onto private properties to remove these trees where the owner is unable or unwilling to do so.

3.0 THE DECLINE OF ASH

Ash has been extensively planted in urban environments as a street tree, and as part of reforestation initiatives. In some Canadian cities such as Ottawa, over 25 percent of the urban canopy is ash, specifically red (green) ash (*F. pennsylvanica*). In addition, most species of ash thrive in disturbed habitats and are often grossly over-represented in both urban and woodland communities as a result of over-planting and past human activities such as logging, animal husbandry or agriculture (ash is thought to have represented only around three percent of the pre-settlement forests of southern Ontario). One of the reasons EAB has had such an enormous impact in Ontario and many areas of the US is the large ash component of many woodlots, especially those in low-lying areas. For instance, prior to the EAB epidemic it was not uncommon for the ash component of many woodlots in south-western Ontario to exceed 50 percent, with some low-lying woodlots being over 90 percent ash. This situation has greatly exacerbated the impact of EAB.

With the anticipated death of millions of ash trees in south-western Ontario alone, EAB is likely to “normalize” the composition of many Ontario woodlots and forests which, in turn will impact on the epidemiology of EAB. Many experts predict EAB populations will sharply decline with the loss of ash and future outbreaks are likely to be far less

damaging. EAB is not expected to disappear however, and populations are likely to rebound with the recovery of the ash component of our forests in future years. Generally speaking the impacts of Invasive Alien Species such as EAB are often attenuated over time as a result of the introduction and/or emergence of biological control agents such as parasitoids, predators and diseases and as well, selection of natural resistance in the host.

In addition to being a major forest pest, EAB has seriously impacted urban forests and streetscapes. According to a recent US study⁵, it is estimated that nearly 38 million ash grow on developed land in at-risk US states and are expected to perish over the next decade. The annual cost to treat or remove and replace dead trees in these areas will exceed \$1 billion per year for the next 10 years. If all dead ash trees in developed areas were removed and replaced, the costs would exceed \$25 billion (US) for the same period.

Lastly (and perhaps most importantly), EAB has already had an enormous impact on the genetic diversity of the genus *Fraxinus*. As with other tree genera, our native ash are the result of millions of years of evolution and natural selection and trees are often well suited to local climate and soil types. The anticipated death of hundreds of millions of ash trees in Canada alone is expected to impact the gene pool and will greatly limit the ability of our native ash to rebound once EAB comes into natural balance with the ecosystem (i.e., naturalised). Ash seeds have a very limited viability and there is evidence that natural seed banks in heavily infested areas will soon be depleted, limiting the ability of ash to rebound and recover its former prominence. To that end, Natural Resources Canada-Canadian Forest Service (CFS) and other agencies are attempting to preserve germplasm representative of the Canadian ash genome.

4.0 BIOLOGY AND LIFE CYCLE

The emerald ash borer (*Agrilus planipennis* Fairmaire) is a beetle belonging to the family Buprestidae (flat-headed or metallic wood-boring beetles). The adult is usually green with black eyes (although ruby coloured and golden eyed “morphs” have been observed), approximately 10 to 13 mm long, with a metallic, iridescent lustre, especially on its ventral surface (underside).

⁵ K.F. Kovacs et al. Ecological Economics (2009)

There are four life stages: egg, larva, pupa and adult (*Figures: 6-10*). The adults, which fly well, begin to emerge in late May and can fly up to 5 km at a time with average dispersal being 10 km/year. Most, however, only disperse a short distance (100m) from where they emerged if suitable host material is present in the vicinity.

It is the larval stage which damages the tree by feeding on and destroying the phloem and outer xylem layers of the tree. Larvae feed unseen under the bark and disrupt the flow of vital nutrients throughout the tree including the roots; heavily infested trees soon starve to death. By the time signs and symptoms are in evidence, the tree is usually in serious decline and will usually die soon afterwards. In areas with established EAB populations trees can be mass attacked and killed in one or two seasons.

EAB eggs, (which are extremely small), are laid only on ash trees from June to late August. These soon hatch into tiny larvae which then mine inward through the outer bark into the cambial layer beneath where they rapidly grow and undergo four larval stages (known as instars). EAB overwinter under the bark as either immature larvae or in a pre-pupal larval stage. Pupation takes place from early spring until early summer. Peak emergence of adults in Canada is from mid- to late June. Adults are rarely observed after mid-August.

The completion of its life cycle may take either one or two years. Eggs laid later in the summer do not usually have time to complete their life cycle in the current season, especially in cooler areas and the insect will overwinter under the bark as an immature larva.

In its native range of eastern Asia, EAB naturally occurs in areas of extreme temperatures and is very cold tolerant. Research has confirmed that EAB is capable of surviving anywhere in Canada where ash will grow and there is no reason to believe that climate will limit the extent of its range in North America.

5.0 SIGNS AND SYMPTOMS OF INFESTATION

In North America, EAB has only been observed to attack true ash trees (genus *Fraxinus*).

EAB populations are usually at low levels following introduction to a new area and it is extremely difficult to detect for several years. Once established, populations build up

exponentially to epidemic levels but it is usually four years or more after the initial infestation before signs and symptoms are manifested in the host tree and EAB can be reliably detected. Recent research confirms that attack is often initially confined to branches in the canopy and that no signs of EAB may be evident in the trunk until later in the infestation when populations are much higher and the tree is declining. This is a major limitation to early detection and management.

5.1 Signs of EAB infestation are:

- Presence of EAB life stages (egg, larvae, adults and pupae⁶) (*Figures 6-10*)
- Serpentine galleries (often in evidence beneath bark cracks) (*Figure 11*)
- Presence of D-shaped adult emergence holes in the bark (*Figure 12*)
- Evidence of larval feeding by woodpeckers and squirrels (*Figures 13 and 14*)

5.2 Symptoms of EAB infestation are:

- Death of tree or parts thereof
- Thinning and yellowing of the crown, especially late in the summer (*Figure 15*)
- Cracks in the bark along trunk and branches (*Figure 16*);
- Presence of epicormic shoots on stems and branches (*Figure 17*)

⁶ Eggs are extremely small and are not used as a diagnostic feature

Figures 6-10: EMERALD ASH BORER LIFE STAGES



Figure 6: Egg⁷



Figure 7: 4th Instar Larva



Figure 8: Adult (G. Wood, CFIA)

⁷ All Photos courtesy of B. Lyons, CFS, except as noted



Figure 9: Emerging Adults⁸



Figure 10: Pupa

⁸ All Photos courtesy of B. Lyons, CFS, except as noted

EAB SIGNS AND SYMPTOMS



Figure 11: Serpentine Galleries under Bark ⁹



Figure 12(a, and b): D-shaped Emergence Holes

⁹ Photographs courtesy of CFS

EAB SIGNS AND SYMPTOMS



Figure 13: Woodpecker Feeding¹⁰



Figure 14: Woodpecker Feeding

¹⁰ Photo Credit: Sarah Jane Miller, City of Mississauga

EAB SIGNS AND SYMPTOMS



Figure 15: Thinning/Yellowing Crowns¹¹

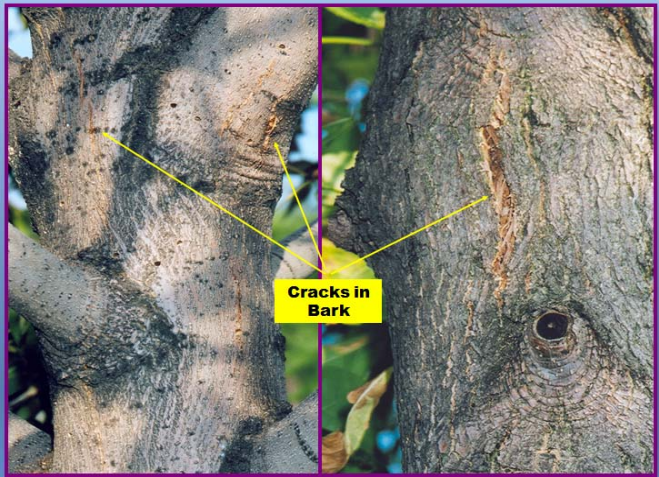


Figure 16: Bark Cracks caused by developing larvae

¹¹ All photographs – K.R. Marchant

EPICORMIC SHOOTS/ BRANCHING

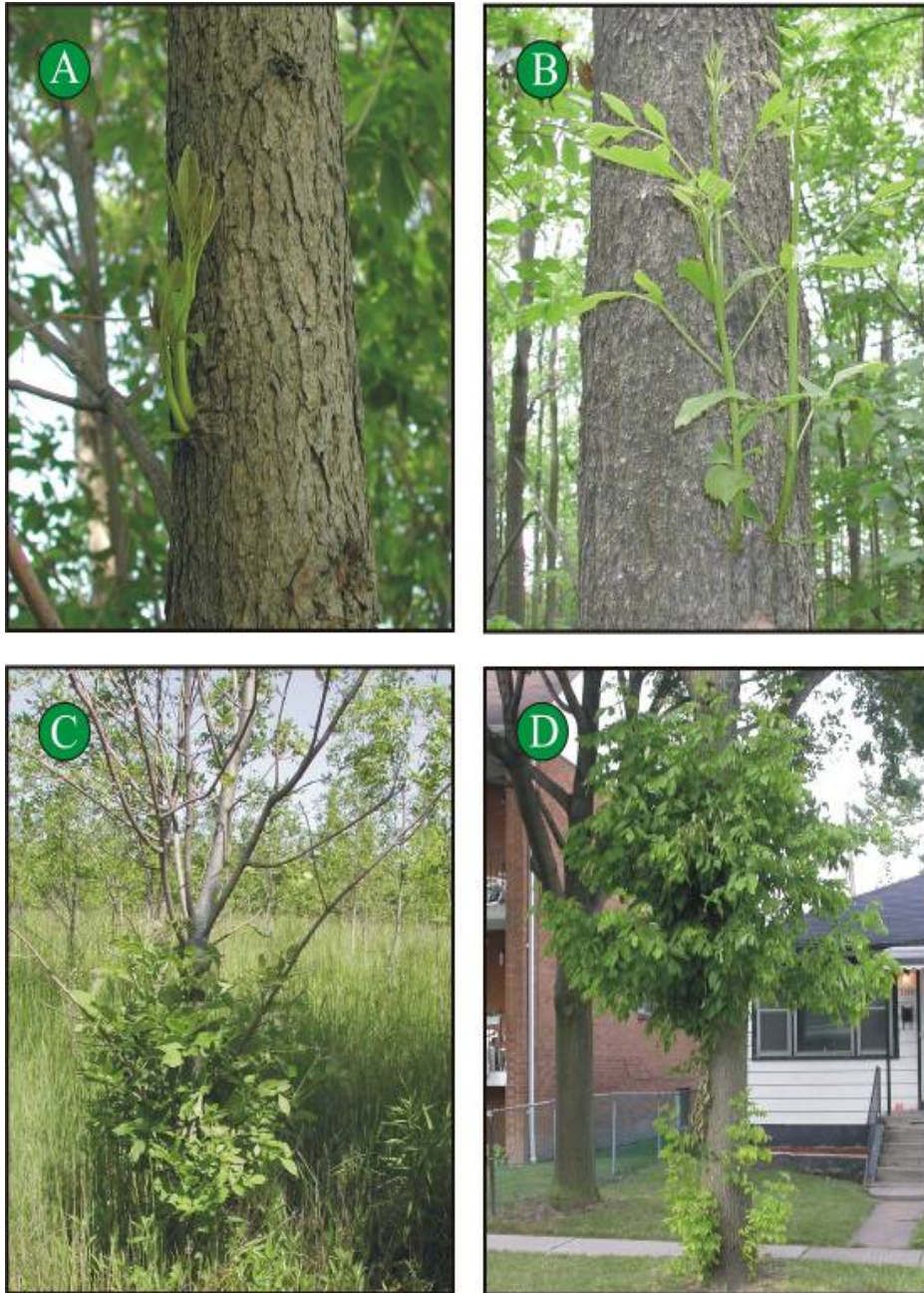


Figure 17:

A and B: Emerging epicormic shoots on infested trunk,

C: Basal shoots on tree with dead crown,

D: Older epicormic shoots on declining tree (these died shortly thereafter).

Photographs courtesy Barry Lyons, CFS

6.0 STRATEGIES TO COMBAT INVASIVE ALIEN PEST SPECIES

6.1 Selecting the appropriate strategy

For newly established plant pests of potential quarantine significance, regulatory agencies such as the CFIA are generally required to complete a pest risk assessment (PRA) which outlines the risk posed to the country by an organism. PRAs take into consideration such factors as: potential pathways, potential of the organism to inflict damage, potential to establish in the country, climatic suitability, host suitability, impact on markets, environment, etc. Prior to making a decision on the appropriate strategy, it is common practice for the regulatory agency to establish expert panels consisting of scientists and regulatory specialists from government, industry and academia to provide it with advice. The selected action should be:

- Science-based,
- Transparent,
- Easily communicated and understood,
- Defendable,
- Cost effective
- Legal within the purview of the Plant Protection Act and Regulations, and other applicable legislation

As a general rule, if the regulatory agency elects to undertake proactive measures such as eradication, containment, slow-the-spread etc., there must be a realistic chance for success, and/or measurable results of mitigating the impact of the IAS. An integral part of the decision making process is an environmental assessment of the potential impact of the pest, as well as any proposed actions to manage it. For these reasons, control actions are generally not taken against many IAS pests; it is simply not cost effective to do so, and there is little likelihood of a successful outcome.

Numerous strategies are employed by plant quarantine specialists and agencies to combat IAS such as EAB. Ideally, these are science based and rely on pest risk assessments to score out the potential for an organism to become a damaging pest in a new area. Strategies to mitigate the impact of potential plant pests include but are not limited to:

6.2 Exclusion

This entails the elimination of pathways for the introduction of a potential pest to a new area through the enactment of stringent import regulations which may prescribe treatment of the commodity (such as heat or pesticides), or outright prohibition of the commodity in its raw form. Exclusion is often the most effective of the mitigation options

but is often influenced by political considerations and must have a sound footing in science to justify it.

6.3 Eradication

This strategy entails the eradication of a potential pest prior to it multiplying and spreading in a new area. This is the preferred option where introduced pests are encountered soon after introduction. Unfortunately, eradication is rarely a valid option as rigid criteria must be met in order for it to be successful. These are:

- A pre-existing PRA outlining the risks posed by the organism
- Early detection prior dispersal from the site of introduction
- Slow rate of dispersal and spread
- Low fecundity
- Ease of detection (visual signs and symptoms, pre-existing survey methodology, such as traps, lures and pheromones)
- Ease of treatment
- Political will and sufficient funding

6.4 Suppression

With this strategy, actions are taken to keep the population at low levels through intervention. These actions greatly lower the risk of spread to new areas and can leave the door open to future eradication of the pest and as well, can protect natural resources and the environment;

6.5 Containment

This strategy entails the taking of pro-active measures to prevent the movement of pests through enactment of quarantine measures and targeted control measures. Containment is the strategy of choice for slow-moving and/or non-vectored pests for which it is not possible and/or cost effect to eradicate;

6.6 Slow-the-Spread

“Slow-the-Spread” is a strategy often imposed by regulatory agencies such as the USDA or CFIA to slow the spread of pests of quarantine significance¹². With this

¹² See definitions

strategy, there is a general acceptance that the pest cannot be eradicated and will continue to spread to suitable areas where it likely to be damaging. For slow-the-spread to be implemented as a regulatory strategy there needs to be demonstrated merit in slowing the spread of the pest to new areas. This could include but is not necessarily limited to such factors as:

- buying time for biological controls to catch up with the pest
- protecting market access for exported products
- limiting economic losses
- environmental considerations

For slow-the-spread to work as a strategy there needs to be regulations in place on the movement of potentially infested products such as nursery stock, firewood, timber or other forest products (in the case of wood vectored pests). In general, the authority to impose regulations of this nature rests at the federal, state or provincial level. Municipalities wishing to impose similar regulations at the municipal level are limited by the Ontario Municipal Act, and would likely experience difficulty in developing and implementing effective regulations.

6.7 Management

This strategy entails living with the pest but mitigating its potential for damage and dispersal on a localized basis through best management practices including biological, chemical or other controls, integrated pest management, public awareness and effective partnerships. Most damaging agricultural and forestry pests (many of which are long established) fall into this category. Not all damaging pests can be successfully managed.

6.8 No Action

For most exotic organisms (many of which are benign or even beneficial, or whose impact has been attenuated through biological control or natural selection of host resistance) there is no need to take aggressive action to contain or otherwise manage them. Many exotic plants and animals in Canada are long established with little or no economic or environmental impact. Some examples of beneficial or benign exotic organisms are honey bees, earth worms¹³ and most of our field crops, fruit trees and

¹³ Earthworms can be a serious pest when introduced into woodlands but are generally considered beneficial in urban and agricultural settings

ornamental plants. Most ornamental plants used in Canada are introduced from elsewhere; some of these, such as buckthorn, garlic mustard, autumn olive, honeysuckle and dog-strangling vine were deliberately introduced for planting in North America and can be very serious woodland pests on occasion.

7.0 MANAGEMENT TOOLS

7.1 Pest Risk Assessment

When scoping out the potential for IAS to become established as damaging pests, the pest risk assessment (PRA) is probably the most useful tool. PRAs are generally based on peer reviewed scientific information and examine such criteria as:

- The pest status of the organism in areas to which it is endemic, and to which it has been introduced and established
- Host ranges (what species does it attack; are these species or close relatives present in Canada?)
- The value of these crops or potential host species in North America
- Cold tolerance and other critical biological information
- Fecundity
- Does it disperse well? Is it a vectored pest, and is that vector present here?
- Ease of establishment... is it a resilient pest which can remain in a dormant state and survive long distance travel?
- What pathways exist (e.g. import of wood packaging materials, dunnage, logs, nursery stock etc.)?
- How difficult is it to detect? Are there pheromones or other lures available?
- If introduced, can it be eradicated? How do other countries manage it
- Other...

PRAs are the basis of effective regulations. A well written PRA can save governments as well as property owners, industries and other stakeholders millions of dollars by permitting pre-emptive actions such as the elimination of potential pathways to be front-end loaded, while, conversely, assisting governments to select the appropriate response to IAS which have managed to find their way here.

7.2 Surveillance

Having a spatial inventory of its ash resource and determining where EAB is present allows a municipality to focus its management and/or impact mitigation activities.

Despite considerable scientific advances in recent years in surveillance technology and methodology, there is still no reliable method for early detection of EAB at low population levels. EAB does not randomly attack trees and the minimum sample size required for statistical accuracy remains a question. There are little or no statistical data by which to determine confidence intervals and scientists have yet to determine the threshold for providing confidence that EAB is not present in the target area.

While essential to successful management programmes this is likely to remain a limiting factor for the foreseeable future.

Two complementary surveillance strategies are commonly used in the management of quarantine pests such as EAB, namely: **detection**, and **delimitation**.

7.2.1 Detection Surveys

Detection surveys are used to determine the presence or absence of a pest in a target area. They are not generally useful in determining epicentres of infestation or the intensity or age of the infestation.

Detection surveys are designed to gather qualitative, rather than quantitative data; it is generally not important to regulatory agencies to know how many insects are present in an area, just whether they are present or not. On the basis of these data, quarantines may be imposed on defined areas (such as Counties or Regional Municipalities). Statistical significance can be an issue, especially where traps (or other tools) are unable to consistently detect the presence of the target organism at low levels. With specific respect to EAB there is a yet-to-be determined population threshold at which the statistical accuracy is unacceptably low, and false negatives occur. Conversely, insects may be blown or otherwise transported into the target area, resulting in false positive results.

EAB detection surveys are most often predicated on finding physical evidence of a life stage of the insect in a host tree or nearby trap. Visual detection of signs and symptoms in the tree is desirable prior to declaring an area as infested. When conducting detection surveys, risk based protocols are employed and priority given to high risk sites where EAB is likely to have been introduced through human activities.

High risk sites are defined as:

- Campgrounds and trailer parks
- Sawmills and firewood purveyors
- Tree nurseries and garden centres

- Traffic corridors (such as rest-stops along major highways)
- Industrial areas containing importers of crate and other wood packaging materials

Targeted detection surveys have proven quite effective in locating previously undetected infestations in new areas and allow regulatory agencies to focus often limited resources on key result areas.

Many Ontario municipalities now use prism traps in conjunction with visual surveys and branch sampling to detect EAB.

7.2.2 Delimitation and Monitoring Surveys

Delimitation surveys are used to determine how far a population has spread from, or around an established outlier or point of introduction. Delimitation surveys are generally used in areas known to be infested and are designed to gather quantitative data. For this reason they are best suited to situations where it is important to determine the density and distribution of the pest around what is perceived to be the point of introduction to the area (an outlier), or conversely, determine the leading edge of an infestation. While delimitation surveys are more accurate with respect to determining the age and severity of an infestation, they are generally far more labour-intensive and expensive to conduct than detection surveys.

Many Ontario municipalities are currently using delimitation surveys to monitor EAB population build-up and dispersal, and to prioritize areas for possible treatment. These surveys will also enable those municipalities which are currently actively treating trees to monitor the decline of EAB in its post-epidemic phase. It is anticipated that current municipal treatment programmes can either be discontinued or scaled back (with considerable cost savings) once EAB populations decline and “normalize”. This is expected to occur within 10 years in many southern Ontario municipalities which currently treat trees.

As with detection surveys (and with specific reference to EAB), delimitation surveys become statistically inaccurate below a yet-to-be determined population threshold and are unlikely to detect low level infestations.

7.2.3 Survey Methodology

Four survey methodologies are currently employed in Canada and the US for EAB:

- Prism traps and/or Lindgren Funnel Traps baited with plant volatile lures (semiochemicals) and short range, or contact pheromones
- Visual (examination of trees for signs and symptoms of EAB such as emergence holes, larval galleries and canopy decline)

- Branch sampling¹⁴
- Aerial and Hyperspectral Imaging (HSI)

7.2.3.1 Prism Traps

The CFIA and CFS currently recommend the use of green prism traps to detect EAB. These are baited with chemical lures known to be attractive to EAB and are coated on their outside surface with a sticky substance to trap adults beetles.

Research conducted in Canada and the US has confirmed that prism traps are now relatively effective in detecting EAB prior to signs and symptoms being manifested in infested trees and are significantly more reliable than visual survey alone.

Prism traps are most effective when used in a detection context and for that reason are used by regulatory agencies and municipalities where it is important to ascertain the presence or absence of EAB in a given area. Data are not quantitative and the inconsistencies in the efficacy of the lures (as well as other sensitive parameters) do not allow for comparison between areas, or different sampling years¹⁵. While traps are unable to determine with any accuracy how many trees in a target area are infested, they are effective at determining the presence or absence of EAB in the area with a certain degree of statistical accuracy. At low population levels, there is a high risk of false negative data and it cannot be assumed that a given area is free from EAB if no adults are captured. Conversely, adult beetles may be blown in or otherwise transported to the survey area resulting in false positive results.

When deployed in a grid pattern in urban areas or along the edge of woodlands, they can provide an indication and early warning as to the presence of EAB. The actual density of traps required to provide confidence that EAB is/is not present is still unknown and more research is required¹⁶. Traps should only be placed in areas where ash trees are present and the density should be increased in areas deemed to be higher risk (such as around parks, sawmills, highway rest stops, firewood purveyors, industrial areas and campgrounds).

Detection thresholds have not been established for prism traps and their degree of attractiveness is thought to vary from year to year and location to location¹⁷. To this end, researchers are currently working on correlating the number of beetles caught in the traps to populations in local trees.

To be effective, traps must be deployed immediately prior to the emergence of adult beetles (which is late May to early June in southern Ontario in most years) and checked

¹⁴ Krista Ryall, *Detection of Emerald Ash Borer in Urban Environments Using Branch Sampling*, 2010. *Natural Resources Canada, Canadian Forest Service, Technical Note 111*

¹⁵ Personal Communication OMNR/CFS,

¹⁶ See ¹⁰

¹⁷ See ¹⁰

at regular intervals. Traps must be removed at the end of the flight season (usually mid-August) and all suspect insects collected and identified at that time.

Of note is that traps used in Canada are green and baited with Z-3-Hexenol (a synthetic green leaf volatile compound known to be attractive to Buprestids and other insects) and short range or contact pheromones; the US uses a purple version of the trap baited with manuka and/or phoebe oils. The placement of prism traps is now the detection methodology of choice in the US.

Regulatory agencies stress that an added benefit of the traps (especially the purple variety) is that they are highly visible to the public (resulting in free publicity for the agency deploying the traps).

7.2.3.2 Lindgren Funnel Traps

Green, Lindgren funnel traps were first tested in Canada in 2011 by the CFS. They are baited with the same Z-3-Hexenol lure as prism traps but rely on the beetle being trapped at the bottom of a series of specially designed funnels coated with Fluon® (an aqueous solution applied to the funnels to make them more slippery). Unpublished data show the traps to be up to ten times more effective at attracting EAB adults than the prism traps currently being used by the CFIA and many municipalities. While somewhat more expensive than the prism traps on a per unit basis, they are reusable and could be a cost-effective alternative to prism traps (which are sticky, difficult to handle and to dispose of). At the present time, their large size and vulnerability to vandalism has made them an impractical alternative to prism traps in urban areas and they are not being used in Canada other than for research purposes.

7.2.3.3 Visual

Visual surveillance entails the examination of trees for EAB infestation from the ground and/or canopy level. It relies on the physical manifestation of signs and symptoms in the tree which may not be apparent for as long as five years after the initial attack and can easily be missed in their initial stages.

Visual surveillance is ponderous, subjective and time consuming and when compared to other survey methodologies such as branch sampling is far less accurate. It is often impractical to inspect all trees in an area, and for this reason it is advisable to target areas around known risk-makers such as lumber yards, campground, parks sawmills or firewood purveyors.

7.2.3.4 Branch Sampling

The delimitation tool of choice in Canada is now branch sampling, using a technique recently developed by Natural Resources Canada-Canadian Forest Service (CFS). This technology entails the sampling and dissection of several branches from the crown of at-risk ash trees. While the statistical accuracy of the methodology is still being

worked out, research conducted by the CFS has confirmed that this technique is far more accurate with respect to early detection of EAB than visual inspection for signs and symptoms and allows EAB to be detected and quantified in an area several years earlier than previously experienced.

While considerably more labour intensive (and expensive) than deploying traps or conducting visual surveys, branch sampling provides information on the severity and age of the infestation and the potential distribution and dispersal of EAB around the outlier's epicentre (generally the point of introduction). It can, however, be integrated with routine maintenance activities conducted by municipal forestry departments and peeling and debarking operations (which should optimally be done indoors) can be scheduled for non-peak periods. For this reason it is recommended for use by municipalities interested in managing, mapping or otherwise determining the extent of confirmed EAB infestations and protecting trees.

It is conceded that more research is required in order to standardize the interpretation of data collected from branch sampling, especially when it is used for determining whether trees should be removed or treated¹⁸.

Many of the experts contacted for this report believe a strategy combining both trapping and branch sampling is preferable where management is the desired objective.

The CFS is currently developing a modified, scaled-down version of the branch sampling technique to make it more useful and cost effective as a detection survey tool.

7.2.3.5 Hyperspectral Imaging (HSI)

The Natural Resources Canada-Canada Centre for Remote Sensing defines Hyperspectral Imaging as: "The simultaneous acquisition of images of the same area in many (usually 100 or more), narrow, contiguous, spectral bands. The detailed spectrum resulting from hyperspectral imaging allows the comparison of the remotely-acquired spectrum to the spectra of known materials".

Plainly speaking, HSI is a type of remote sensing whereby data are collected for specific bandwidths of reflected light (usually infrared), rather than the multispectral (visual light) images acquired from satellites or aircraft. While still in its developmental stage and highly proprietary, HSI could prove to be a useful tool to identify and map trees and other vegetation from the air, and to possibly differentiate healthy from unhealthy trees. With specific reference to EAB, HSI has recently been assessed in both Milwaukee, WI, and Oakville, Ontario (2010).

¹⁸ Personal Communication OMNR/CFS

For HSI to work as a tree identification tool, it first requires spectral data to be collected by a handheld recorder from several individual trees of a target species. Each species is believed to have a unique spectral signature and with the aid of advanced software, “algorithms” are developed for each species which allow them to be mapped.

The second phase of the operation is the collection of aerial data using low flying aircraft equipped with specialized sensors. Numerous flight paths are required to collect sufficient data and there are many variables such as time of day, and season which have to be taken into account. Current technology allows for the collection of high resolution spectral images which can be superimposed on visual maps, correlated with the data collected by handheld recorders and then integrated with Global Positioning System (GPS) and LIDAR¹⁹ data. Theoretically, it could be possible to accurately identify street and woodland trees from the air without the need for extensive ground-truthing.

The major issues (and barriers) with respect to recommending HSI as a valid tool at the present time are the paucity of empirical data published in peer-reviewed journals, and its relatively high cost when compared to other methodologies. Much of the research being done on HSI is industry-driven, with the technology being developed and evaluated being both cutting edge and highly proprietary. Of note, is that the USDA-Forest Service was involved in a trial conducted in Oakville in 2010 and has agreed to analyze data collected there. Results from the Oakville trial show HSI to have been around 80 percent accurate in the identification of ash trees from the air (which meets the original target accuracy set at the outset of the trial).

While HSI is an exciting, cutting edge technology holding lots of promise, it has, in the opinion of many researchers yet to be proven to work well enough to be recommended for use by municipalities or others interested in managing EAB or other forest pests²⁰. Furthermore, it is expensive with these costs being fixed and even if its accuracy can be improved, municipalities and other jurisdictions in Canada may wish to opt for more cost effective and proven methods of data collection with respect to the management of urban forests and woodlands. For these reasons, HSI cannot be recommended at this time for use in either identifying ash, or as a detection tool for EAB.

7.2.4 Biological Survey Tools: *Cerceris fumipennis*

In addition to sticky traps, the CFIA and other regulatory agencies are currently assessing the use of a native wasp species, *Cerceris fumipennis* to detect EAB adults in newly infested areas. This wasp actively searches out EAB and its North American relatives (genus *Agilus*) and may be of use in detecting low-level infestations in the

¹⁹ LIDAR is an acronym for Light Detection And Ranging

²⁰ Personal Communications: USDA-FS and OMNR

future. Colonies of this wasp can be moved from one location to another and research is continuing in both Canada and the US on its use as a detection tool.

7.3 Pre-Emptive Tree removal

This strategy entails the removal of all ash trees in an area, regardless of infestation status, prior to their death from EAB. While priority would be given to the removal of structurally unsound or unhealthy trees, all ash trees would be pre-emptively removed prior to the onset of EAB induced mortality. While large scale ash removal would have only a minimal impact on reducing overall EAB populations in a generally infested area (such as southern Ontario), it can mitigate long-term costs and liabilities associated with passive or reactive management strategies. All major cities interviewed in conjunction with this report were of the opinion that having a management plan which included proactive tree removal as a component would result in considerable cost-efficiencies as well as reducing the potential for hazards and liabilities.

Notwithstanding, several researchers have put forward counter arguments that maintain that the ash component of the urban canopy should not be removed until it is in decline. The premise here is that large trees (including ash) contribute significantly to the amelioration of the urban environment by virtue of their aesthetic values through air and water purification, reduction in urban heating and by acting as habitat and to prematurely remove them in the name of cost effectiveness cannot be justified.

7.4 Treatment with Registered Pest Control Products

Pesticides have now been proven to be effective in prolonging the life of many at-risk trees if administered prior to a tree being attacked by EAB or in the early stages of infestation. They are most effective when used on a prophylactic basis for non-infested trees in high risk areas. In order to be effective, pest control products used against wood boring insects need to be systemic and the most effective means of getting these into the tree is to inject them under pressure into the trunk (several systems are available)²¹. For this technology to be successful, the tree has to be in good health and have a relatively intact vascular system to permit translocation of the product. Unfortunately, by the time many EAB infested ash trees express symptoms such as crown thinning or die-back, they are usually heavily infested and their vascular tissues extensively damaged and as a result, they cannot be successfully treated.

²¹ Some products such as Imidacloprid can be applied by way of a soil drench but this formulation is not registered in Canada at present for use against EAB and research confirms it to be of limited efficacy

Trees experiencing stress as a result of drought or other abiotic factors are often unable to uptake and translocate injected pest control products. This phenomenon has been cited by researchers as the primary reason for the apparent failure of some treated trees to ward off attacks by EAB, especially where the populations of the insect are high.

While the continued use of some pressurized injection systems has been shown to damage trees around injection sites and predispose them to rot inducing organisms and other mortality factors, this has not been identified as a major issue to date for trees injected for the control of EAB in Canada. However, product labels for Confidor 200SL specifically mention that trees should not be injected any more than every two or three years because of this risk factor.

The current product of choice for most EAB affected communities in Canada is Azadirachtin (TreeAzin™), a natural product insecticide extracted from the neem tree (*Azadirachta sp.*). There is now published, peer-reviewed data that confirm that this product can provide good protection against EAB for a two year period when injected into a relatively healthy ash tree prior to attack by EAB. Injections with this product using the patented EcoJect® system do not appear to be as damaging as other injectable pest control products using other application devices.

Application rates and frequencies for this product are still being fine tuned, based on on-going research in heavily infested areas in Canada and the US. The distributor, BioForest Technologies Inc., now recommends that for trees known to be infested, or located in heavily infested areas, injections be made for the first two years, and then every second year after that. They are also recommending that treatment not be delayed in areas which are likely to be infested.

Full registration for TreeAzin™ was granted by the Pest Management Regulatory Agency of Health Canada (PMRA) on May 25, 2012 and the product is now commercially available. Under the terms of the registration, TreeAzin™ may only be administered using the EcoJect® injection device (a spring loaded canister inserted into a pre-drilled hole at the base of the tree). With specific reference to Ontario, technicians using this and other pest control products which must be injected are required to hold the appropriate Ontario Pesticide Applicator's Certificate. For this reason, these products are not available for use by homeowners and may only be used by certified and licensed professionals.

Two other products are currently registered in Canada for use against EAB. ACECAP®97, an organophosphate systemic insecticide implant received a label extension in 2010 from the PMRA to include EAB, and the label for Confidor 200SL was extended by PMRA in May 2011.

ACECAP[®]97 is effective against a large number of tree insects and is approved for use on a broad range of hosts. While trials conducted in the US conclude that it can kill EAB larvae and provide a degree of protection, it is not considered by researchers to be as effective as other products on the market in Canada or the US and may not work where populations of EAB are high. The label approved by the PMRA in June of 2010 for ACECAP[®]97 states: "Treatment reduces populations of emerald ash borer larvae and the damage they cause, but may not provide control of this pest". While significantly less expensive than TreeAzin[™], its mammalian toxicity is much higher and it must be injected yearly to be effective. Furthermore, the hole into which the ACECAP[®]97 implant is placed is considerably larger than that used for TreeAzin[™] with greater potential for rot inducing organisms to be introduced into the tree. Despite this product not being recommended by US or Canadian researchers at least one small Ontario municipality and several pest control companies in EAB infested areas are currently using it. To date, it is still too early to know if this product will be successful and provide an alternative to TreeAzin[™].

Confidor 200SL is a formulation of Imidacloprid previously approved for use on a variety of forest pests in Canada and the US. It has been assessed in the US for use against EAB and was not considered effective enough to be recommended by most researchers and regulatory specialists. Its label, approved by the PMRA lists it as a Restricted Use Product and "it can only be used in conjunction with federal, provincial, or municipal control programs"; a permit is required from "pesticide regulatory authorities". Confidor is currently being assessed on a trial basis by the City of Ottawa as a possible alternative to TreeAzin[™]. To date, results from this trial are not available.

Neither ACECAP[®]97 nor Confidor 200SL is considered by the Provincial Forest Entomologist or CFS researchers to be acceptable for controlling EAB, especially when populations are high and for this reason the author does not endorse their use in Canada for the management of EAB at this time at the municipal level.

As of May 2010, TREE-äge[®] (Emamectin Benzoate) has full registration in the US as a restricted use pesticide and is widely used by municipalities and homeowners in EAB infested states. Research conducted in the US confirms that it is highly effective for at least two years making it a cost-effective alternative to cutting. Its drawbacks are its relatively high mammalian and aquatic invertebrate toxicity, and its high residual activity. Despite its efficacy and widespread use in the US, it is not registered for use against EAB in Canada at this time. While interest has been expressed by some parties in pursuing registration, this has not taken place to date.

7.5 Consultation, Public Education and Outreach

Recent interviews conducted with US and Canadian officials stressed the importance of public education and outreach programmes. It is vitally important to have all stakeholders including property owners, industry, and public interest and environmental groups made aware of the threat posed by EAB and brought on-side. This is best accomplished through effective messaging by public officials, pesticide applicators and environmental groups, as well as consultation with key stakeholders. For this reason, and depending on the management option ultimately selected by municipalities, it is usually desirable to conduct public meetings to explain EAB management strategies.

7.6 Internal Awareness and Education

Most municipalities affected by EAB have been slow to react to the threat posed by this pest. There is often a general reluctance or inability on the part of many municipal Councils to fully grasp the magnitude of the issue and as a result, few Canadian and US municipalities have been able to successfully implement EAB management plans²². To this end, it is paramount that municipal departments dealing with urban forests ensure that elected officials and senior management are fully apprised of the environmental and fiscal impacts associated with EAB, and that these costs are non-discretionary for the most part.

7.7 Managing Trees on Private Property

In most instances, municipalities rarely take responsibility for the removal of trees on private properties. Exceptions are where trees pose a hazard of falling and causing injury or property damage, or where a tree encroaches on both municipal and private property. In this instance action may be taken under property standards legislation to remove the hazard tree. Notwithstanding, the property owner is generally liable for all costs related to treatment or removal of dead or damaged trees.

7.8 Regulatory

Simcoe County and other Ontario municipalities have the authority under the Ontario Municipal Act (2001) to enact legislation to protect the environment and natural resources. To that end, Simcoe County and its local municipalities may wish to consider drafting by-laws providing for the right of employees/inspectors to enter upon

²²Both the Town of Oakville and the City of Burlington were proactive in developing and implementing successful management plans and as a result have retained a significant portion of their publicly owned ash despite widespread EAB infestation. Few untreated trees survive in these areas.

private property for the purposes of inspecting, treating or removing trees infested with EAB or other IAS (assuming this is not already the case).

8.0 THE STATUS OF EAB MANAGEMENT IN CANADA

8.1 Background: Discovery and Response

EAB was confirmed in Detroit, Michigan and shortly thereafter in Windsor Ontario in the summer of 2002. In October of 2002, the USDA and Michigan Department of Agriculture (MDA) convened what would come to be known as the National EAB Science Advisory Panel (hereafter known as the EAB Science Panel). This panel comprised entomologists, quarantine and regulatory specialists from both government and academia and included several members from Canada. The panel was charged with the responsibility of assessing the risk posed by EAB (it had already been determined that it was a primary tree killer of quarantine significance) and developing some prognostications, and short and long-term solutions. The conclusions from this meeting were that EAB would likely become a very serious and damaging urban and forest pest in North America with severe and lasting environmental and economic consequences. Additionally, it was forecast that there would be little chance of eradicating it or even containing it. Eradication was deemed impossible at that time based on the extreme difficulty in detecting EAB at low levels, the absence of effective pest control products in either country (virtual 100% efficacy would be required in a quarantine context), and its apparent widespread distribution in both countries. The strategy of choice was “Slow-the-Spread”²³, with the hoped-for outcome being that natural or introduced biological controls would eventually emerge or could be introduced from eastern Asia. This would also allow for science to “catch up” with respect to survey technology and the development of effective insecticides or bio-controls. While it was believed at that time that EAB had likely spread beyond south-eastern Michigan and south-western Ontario, few experts realized at that time how widespread the actual infestation was.

From the out-set, the position of the CFIA and its Canadian partners was that EAB could not be eradicated but that there was significant merit in slowing its spread or even containing it within Essex County. Accordingly, the CFIA concentrated its efforts on

²³ See Definition

western Essex, where it was believed EAB was confined. Additional measures were taken to prevent the movement of potentially infested ash materials to other parts of Canada. These included

- Issuance of a federal Ministerial Order by which the western portion of Essex County was placed under quarantine;
- Issuance of quarantine notices to property owners with infested trees ordering them to not remove ash materials from their respective properties;
- Removal of all ash trees within a 500 m radius of known infested trees²⁴
- Development of Policy Memorandum D-03-08 which outlined import and domestic movement restrictions;
- Erection of notices along major highways advising of movement restrictions;
- Other communications initiatives to advise people of quarantine restrictions;
- Investigations to determine the source of newly discovered infestations
- Extensive consultation with other provincial and federal government departments, the USDA, and as well, affected municipalities, industries and property owners.

In the fall of 2003, a decision was made by the CFIA on the advice of its Science Committee and with the full support of its partners, to establish an ash-free or “firebreak” zone on the western end of Chatham-Kent. This strategy entailed the designation of a defined geographical area to the east of what was perceived to be the leading edge of the EAB population at that time, and creating a barrier to its natural spread by removing all ash trees within the zone which could support brood populations. In order to achieve this, federal regulations were developed under the Plant Protection Act which mandated the removal of ash trees from private properties in the zone. This area was selected for the zone because of its extremely low percentage of forest cover (estimated at less than two percent), the presence of Lakes Erie and St. Clair which would act as natural barriers and because there was no physical evidence at that time that EAB was established in areas to the east of the zone. Work began on removing ash trees from the zone during the winter of 2003-04, and an estimated 85,000 ash trees were removed by contractors. Despite an endorsement from the CFIA’s partners and Ontario municipalities, a provision for compensation to affected property owners, and a generous tree replacement programme, the creation of the ash-free zone proved immensely unpopular with residents and property rights activists and received considerable bad press. It represented, what most scientists felt was the last chance to confine EAB to south-western Ontario and save the estimated billion ash trees in areas of Canada to the east.

While the zone undoubtedly provided a significant barrier to the natural dispersal of EAB to areas east of the zone, it was very costly to establish and maintain. In 2004 and

²⁴ This resulted in the removal of over 20,000 trees in Essex County

2005, EAB was detected to the east of the zone in Chatham-Kent and an additional 50,000 trees were removed in support of the programme. With the finding of numerous well-established EAB outliers in 2004 and 2005 in areas to the east of the zone including Lambton, Elgin and Chatham-Kent, the zone was deemed redundant and the regulation by which it had been created was eventually retracted. In 2005, tree cutting to slow the spread of EAB was officially abandoned as a management strategy by the CFIA, although some trees around new outliers would continue to be removed in conjunction with scientific research conducted by the CFS and CFIA.

In 2005 and 2006, the CFIA's strategy shifted away from tree cutting with the new focus being on public messaging ("Don't Move Firewood") and quarantine actions to slow the spread. Two major components were:

- The use of nested quarantine zones²⁵ (5 km radial zones around known positive trees) to augment restrictions on movement already in place at the county level;
- Provisions to permit the movement of ash forest products including firewood materials from regulated areas to registered facilities in non-regulated areas

With the subsequent discovery of well established EAB populations at numerous locations to the east including London, Norfolk County, and later Toronto, Niagara, Ottawa, Québec and many other locations around in the GTA it became apparent that localized quarantines and movement restrictions were no longer relevant to the management of EAB in eastern Canada. In 2009, the CFIA abandoned their use and a decision was made to incorporate areas of similar infestation status into a single zone. The current CFIA policy is to amalgamate quarantine zones of presumed similar infestation status and associated risk under a single MO with the objective being to limit the long-distance spread of EAB and protect other areas of Canada through movement restrictions on high-risk commodities. To this end, all municipalities in southern Ontario with contiguous populations of EAB were included in one regulated area under a single MO.

In March of 2011, the CFIA amended the manner in which it regulated new areas. The requirement for new areas to be listed on a Ministerial Order (MO) was removed and new areas need only be listed and described in the Policy memorandum D-03-08. Refer to *Figure 1*.

With the discovery of EAB in the Bradford West Gwillimbury area of Simcoe in November of 2013, Simcoe County is now deemed infested but will not be included in the greater regulated area until new regulations are enacted (see below). As of

²⁵ A quarantined zone within a quarantined or regulated area... designed to slow the spread of quarantine pests in otherwise uninfested areas

February 1, 2014, EAB has not been detected in either the City of Barrie or the Town of Orillia.

Of major concern is that municipalities, CAs and private property owners located in regulated areas and wishing to protect their ash resource are essentially on their own. There are no restrictions in place to prevent the movement of infested materials within greater regulated areas, even to those areas apparently EAB free.

8.2 Current Status

With the continuing discovery of EAB at numerous locations outside of currently regulated areas, it is apparent that EAB is now well established throughout much of southern, central and eastern Ontario, as well as many parts of southern Québec and the CFIA's slow-the-spread strategy is in need of revision. To that end, the CFIA announced in January 2013, its intention to amend how it regulates EAB in Canada and initiated consultation with affected stakeholders in Ontario and Québec. Amendments are scheduled to be implemented in April, 2014.

Changes proposed by the CFIA were:

1. EAB will no longer be designated as a pest of quarantine significance. This change in designation would remove some of the current onus on the CFIA to intensively regulate movement within, to and from areas believed to be generally infested;
2. Notwithstanding, EAB would continue to be regulated in order for Canada to meet international requirements and assure continued market access for Canadian forest products; the movement of ash forest products and firewood (of all species) from the newly defined EAB regulated areas to non-infested areas would continue to be regulated;
3. An expansion of areas currently regulated to include numerous newly detected localized infestations (outliers) not currently included in the regulated area. Many new areas were detected in 2012 and 2013 and there is a high likelihood that numerous new sites will be found in 2014 and beyond.

The CFIA contends that the *status quo* whereby only known infested counties and regional municipalities are regulated is not sustainable and is very expensive to maintain (with little return on its investment). By enlarging the regulated area to include many areas not currently known to be infested but high risk, it maintains that it can still protect at-risk areas of Canada (specifically those areas of Canada to the west of Sault Ste. Marie, Ontario). Ash is particularly valuable in western Canada as an urban and forest belt tree due to its tolerance of harsh conditions.

Furthermore, it contends that its proposed amendments are similar to those implemented by the USDA in 2012 (which currently allow the movement of ash forest products between contiguously infested states, but continue to quarantine outliers in some partially infested states). Under a harmonized policy, ash forest products would be allowed to move to and from regulated areas of Canada and the US with a similar EAB infestation status. Similar policies have been successfully implemented for other regulated wood species.

8.3 Management Options Proposed by CFIA

Three management options were developed by the CFIA in 2013 for consideration by stakeholders and promulgated in a Risk Management Document (RMD-13-01). The status quo, whereby the CFIA only regulates known infested Counties or Regional Municipalities is not an option and is not included in the document for consideration.

These are:

Expansion of the regulated areas to include high risk corridors and represent more accurately the expected distribution of EAB

Expansion of areas to be regulated to include all currently regulated areas as well as buffer zones

Creation of a Collaborative Management Zone to be managed in partnership with Provinces and Municipalities

8.3.1: Option 1: Expansion of the regulated areas to include high risk corridors and represent more accurately the expected distribution of EAB

The existing regulated area (see Figure 1) would be expanded and consolidated to include major highway corridors such as highways 400, 401, 416 and 417 in Ontario. Additional counties which are not directly connected by these highways but where EAB is expected to be found in the near future would also be included. This is the preferred option for the CFIA as it reduces the resources required to manage the programme and provides confidence that EAB would not be present in ash forest products shipped from non-regulated areas.

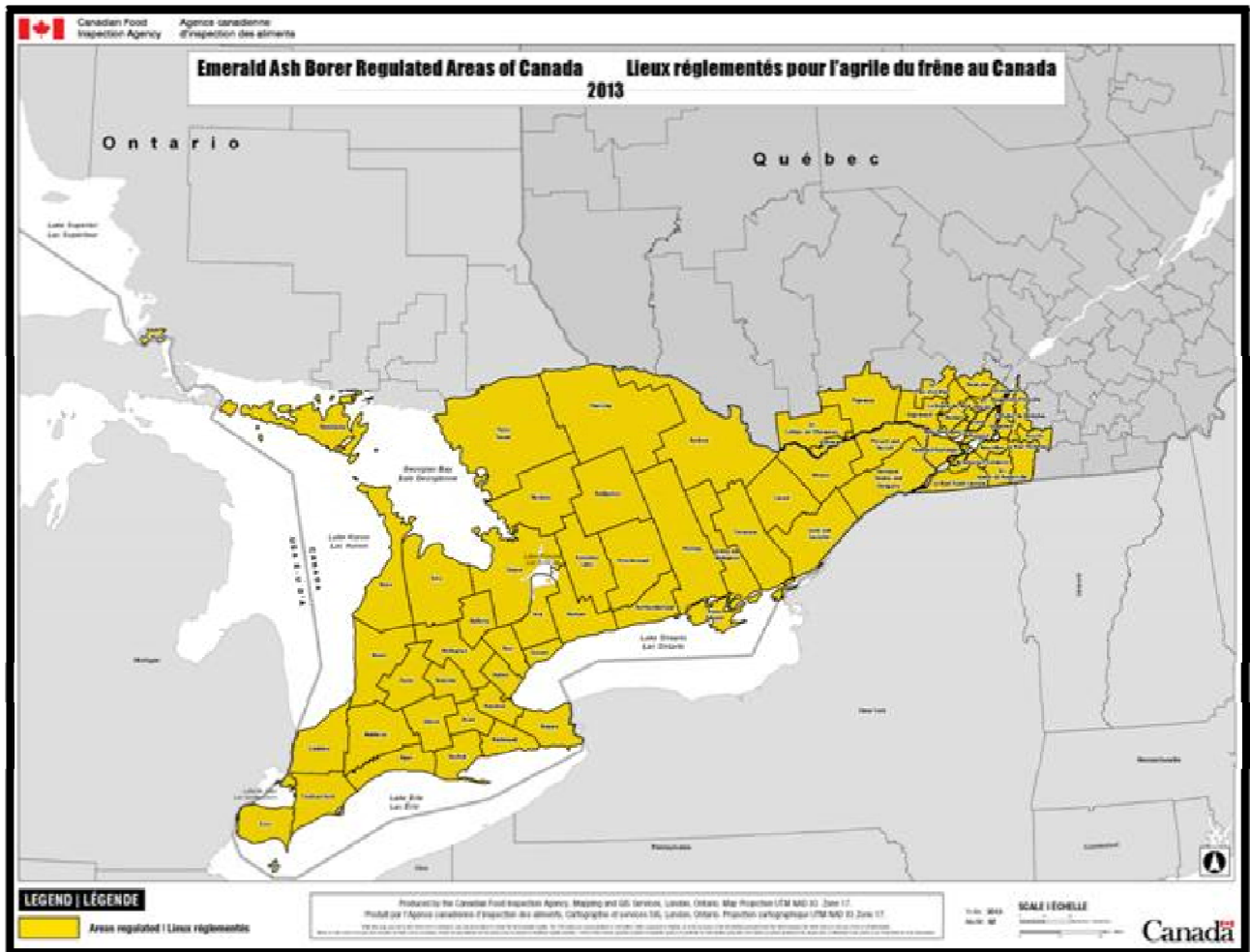


Figure 18: Proposed Regulated Area for Option 1

8.3.2: Option 2: Expansion of areas to be regulated to include all currently regulated areas as well as buffer zones

This option would see all currently regulated areas merged and the new regulated area greatly expanded to include all those areas containing ash and to which EAB is expected to disperse in the future (buffer zones).

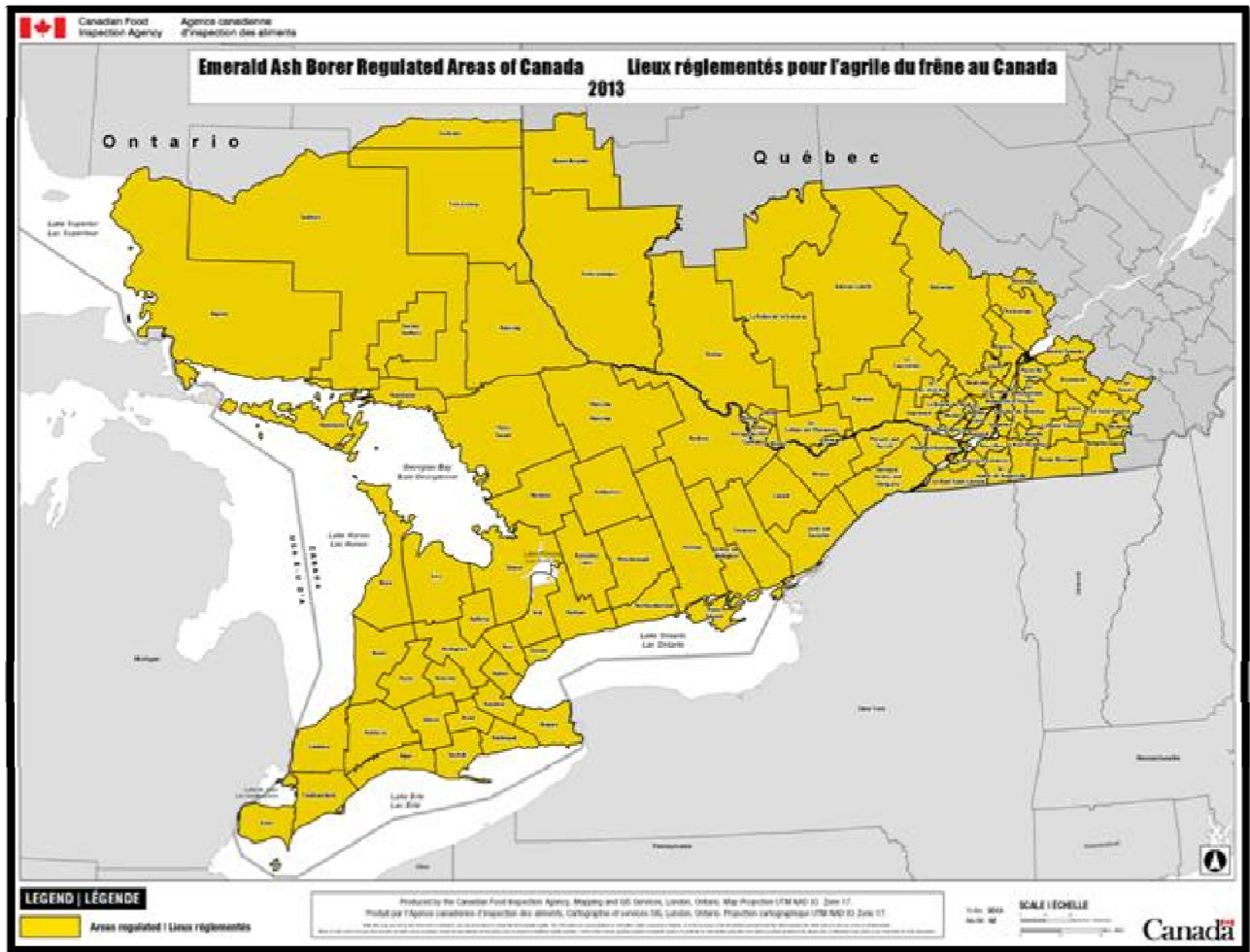


Figure 19: Proposed Regulated Area for Option 2

8.3.3: Option 3: Creation of a Collaborative Management Zone to be managed in partnership with Provinces and Municipalities

This option would see the existing regulated zone maintained. However, new detections would be regulated at the County or Regional Municipality level with financial assistance from the Province and the affected Municipality. The regulated areas would be referred to as Collaborative Management Zones (CMZs).

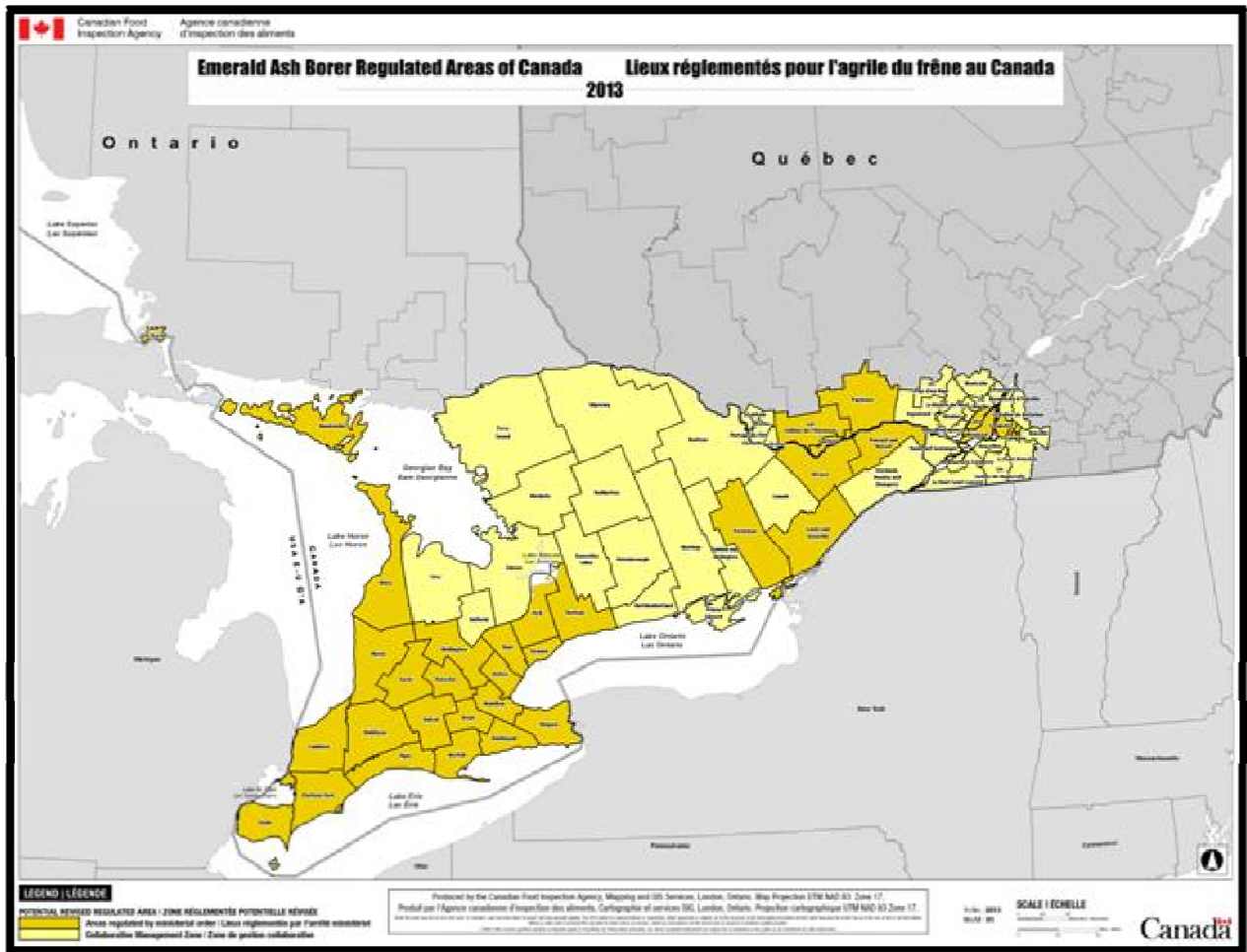


Figure 20: Proposed Regulated Area for Option 3

For all options, the CFIA would conduct risk-based detection and delimitation surveys along the perimeter of the regulated area, taking into consideration the distribution of ash, and various risk factors²⁶. The CFIA has committed to maintaining regulatory oversight on product movement out of the greater regulated area, providing

²⁶ e.g., proximity of the site to campgrounds, sawmills, and parks

communications materials, and supporting continued research on detection and control methodologies.

It maintains that all of these options will provide a greater level of protection for those areas of Canada not currently infested with EAB as they will lower the risk of EAB being moved with ash forest products.

9.0 SITUATION REPORT: SIMCOE COUNTY

9.1 Current Status:

Simcoe County is an upper tier entity comprising 16 municipalities including several which are highly urbanized. Under the Ontario Municipal Act, responsibilities for managing natural resources such as forests and woodlands are split between the County and its local municipalities. Simcoe is responsible for managing its County forests, as well as ash trees along its county roads. Street and park trees in urbanized areas are the responsibility of local municipalities. In addition to those woodlands, forest tracts and natural areas maintained by the County and its local municipalities, the Lake Simcoe, and Nottawasaga Valley Conservation Authorities are responsible for the management of some natural areas and work closely with the County on conservation issues.

Woodlands and natural areas on private properties are the responsibility of the property owner.

The City of Barrie and the Town of Orillia are separate municipalities and are not part of Simcoe County.

EAB was confirmed in Simcoe County in the Town of Bradford West Gwillimbury in November of 2013; the Town is developing a strategic plan to deal with it. To date (February 1, 2014) EAB has not been found in other parts of the County or the City of Barrie or Town of Orillia. Barrie has developed an EAB management plan. This status is likely to change over the next year because of amendments to the way the CFIA intends to regulate EAB and the recent confirmation of EAB in Simcoe County (*Refer to Figures 1, 18, 19 and 20*). Upon inclusion in a regulated area, ash forest products and nursery stock as well as firewood of any tree species cannot be removed from the regulated area without written permission from the CFIA.

9.2 County Responsibilities for Urban Tree Management

While the County's primary responsibility vis-à-vis EAB is focused on managing County forests and on ash trees along its County roads, it enjoys a good working relationship with its local municipalities and frequently cooperates with them with respect to managing IAS. To that end, one of the stated objectives of this document is to provide a template for municipalities wishing to undertake management actions for EAB (see section 10). As an appendix to this document, several management scenarios using examples from real-life situations have been included in Microsoft Excel format. This will assist urbanized municipalities to cost out the various management options available to them and make an informed decision on how best to manage local EAB infestations.

While emergency preparedness also comes under the purview of the County, EAB and other IAS do not meet the criteria for consideration as emergencies despite their potential for serious environmental and economic harm.

9.3 Prognosis... Potential Impact and Costs

9.3.1 County Forests

The Simcoe County Forests (SCF) have continued to expand in recent years; at the end of 2012 the land base totalled 12,873 ha (31,809 acres). Due to the long history of land reclamation, approximately 50% of its forests are in plantations and the remainder a mix of natural forest types. Current inventory data indicates that just under 10% of the total SCF area contains a minimum component of 10% ash. Harvesting records from the previous 15 years are consistent; 10% of the volume of hardwood timber has been ash. As such, the loss of ash species will have a future economic impact in addition to the loss of biological diversity. Also, as the SCF represents approximately 6% of the forested area in Simcoe County, it can be assumed that the impacts on private and crown lands will be similar.

The SCF is considered a 'working forest', and although recreational use is prevalent throughout Simcoe County, the County has no existing programme to specifically reduce hazardous trees along access roads and trails. All "designated" trails in the SCF are maintained through property use agreements with a number of organizations. That said, potential hazards are targeted for removal during regularly scheduled selective harvesting operations. Stands containing a higher percentage of ash will need to be assessed and potentially prioritized for removal in the operating plan.

9.3.2 County Roads

Ash is a commonly encountered genus along rural roads in most of southern, central and eastern Ontario. In the fall of 2013, Simcoe undertook a roadside survey to determine the estimated number of ash it could expect to lose once EAB becomes established. While it was not possible to survey all 872 km of roads for which the County is responsible, or which border on adjacent municipalities, the survey was designed to sample approximately 2% of its roadside trees. To achieve this, 0.1 km sections were selected from each 5.0 km section of roadway. All ash trees encountered in these sections were counted, separated into four size class and assigned a hazard rating.

Based on this survey, it is estimated that there are approximately 6,900 ash trees along Simcoe County roads with an average size of 20 cm diameter breast height (dbh). Only trees posing a hazard upon death would be removed. Approximately 2,300 to 3,450 trees fall into this category. Simcoe estimates that felling these trees, chipping brush *in situ* and leaving large dimension wood for use by landowners would cost around \$200/tree, amounting to a total of \$690K just to deal with hazard trees. This does not include trees on roads maintained by local municipalities nor does it take into consideration replanting of dead ash with other species (which is not being considered at this time).

Simcoe has developed a policy to address the risk of EAB being moved by persons harvesting firewood from roadside trees and moved outside of the EAB regulated area. See section **13.3**.

9.3.3 Waste Disposal

Research conducted by US scientists on the potential for EAB to be moved in chips and other compliant ash materials concluded that these commodities are extremely low risk. Ash materials can be made compliant by chipping or grinding to 2.5 cm in any two dimensions, and/or through: heat treatment, composting and other processes acceptable to the CFIA. Their removal from EAB regulated areas is restricted under current CFIA regulations. For this reason, Simcoe is not able to receive ash forest products including waste materials from neighbouring municipalities at this time unless the risk has been mitigated through processing and written permission given by the CFIA. This situation will change by virtue of EAB being found in Simcoe and with the impending inclusion of Simcoe in a greatly expanded regulated area which will permit the free movement of ash materials (**see sections 8.2 and 8.3**). Because there will be no restrictions on these materials moving to or within Simcoe from areas with generalized EAB infestations the potential for EAB to spread rapidly throughout Simcoe will be exacerbated when this occurs. The new regulated areas are expected to be in place April, 2014.

Yard waste materials are not regulated where it can be demonstrated that they do not contain ash and can be moved freely.

The major long-term challenge facing the County and its local municipalities will be the removal and disposal of dead ash trees in future years. While many roadside and forest trees can be left to fall and rot, most publicly and privately owned urban trees adjacent to buildings and roadways have to be removed prior to, or soon after death to reduce the hazard. The financial and environmental impacts of this can be off-set or minimized through prudent planning and management.

To this end, Simcoe has developed an action plan to deal with increased volumes of wood products to its disposal sites and to mitigate the risk of EAB being spread through movement of infested materials. See section **13.5**.

9.3.4 Financial Assistance to Municipalities and Property Owners

Hazard tree removal in urban areas is non-discretionary; dead ash trees often pose a hazard and must be removed promptly as they decay within a few years of death. Along with municipalities, private property owners in urban areas will also be heavily impacted (the average cost for removal of a mature urban tree ranges from \$1,200 for a street tree to \$2,500 for privately owned trees). While Simcoe County *per se* may not be greatly affected by this, its local municipalities, especially those with large numbers of urban ash trees will be and they need to plan accordingly.

At present there are no federal or provincial monies available to assist with this and many municipalities across Ontario and Québec are being severely impacted by EAB with the potential cost for tree removal alone running into the hundreds of millions of dollars over the next ten years. Accordingly, in response to a 2011 initiative spearheaded by the Association of Municipalities of Ontario, the Federation of Canadian Municipalities and the Northwestern Ontario Municipal Association, most major municipalities in Ontario and elsewhere in Canada petitioned both the Federal and Provincial governments for additional funding, to offset these costs. As well, the Ontario Urban Forest Council in a letter dated February 12, 2012 is urged affected municipalities and property owners in Ontario to further petition the Federal and Provincial government for support in combating EAB, and to play a much larger role in maintaining urban forests in general.

9.4 Partners and Stakeholders

Simcoe County enjoys a close working relationship with its 16 local municipalities, its local conservation authorities (the Lake Simcoe, and Nottawasaga Valley Conservation Authorities), the Ontario Ministry of Natural Resources (OMNR) and as well, Orillia and

Barrie. Numerous other organizations are consulted in the management of its natural resources and County Forests.

10.0 MANAGEMENT OPTIONS

10.1 Background

With respect to the management of EAB in Simcoe County three primary components have been identified:

1. County Forests and natural areas (including hazard trees along public pathways and trails);
2. Trees along county roads managed by the County or, on behalf of the County by its local municipalities²⁷;
3. Management of ash trees in urban settings

For ash trees in urban settings managed either by the County or its local municipalities, three management options are listed and explained in *sections 10.4 and 11.0*.

10.2 Woodland Management

Due to the relatively low percentage of ash in its County Forests (less than 10 percent) and the extreme difficulty of managing EAB or mitigating its impact in these forests, the County's only available options are:

1. To pre-emptively log the ash component of its forests, or
2. Allow them to die and treat them as any other dead species

Ash trees adjacent to public pathways and trails in County Forests would be treated the same as any other hazardous tree species.

At nearly 32,000 acres (12,873 ha) distributed over approximately 130 properties the Simcoe County Forests are considered 'working forests'; not 'parks'. Although generally open and available for many recreational pursuits (as defined in the Recreation Policy), to date the County has not actively managed trails or maintained access roads or other infrastructure for recreational use. As such, a level of risk must be assumed by users who utilize the forest, as is the case in all natural areas.

²⁷ This has not been identified by the County as having a major impact

All 'designated' or marked trails are accomplished through partnerships with user groups with standard Property Use Agreements. Approximately fifteen agreements are signed annually with non-profit groups including snowmobile, ATV, and off-road motorcycle associations, hiking trail associations, and mountain bike clubs. Several commercial agreements also exist for ongoing use and individual events. In addition to providing liability insurance to provide a level of protection to the County, these agreements detail the responsibilities and limitations of the user including marking, mapping and maintaining trails. While this includes the removal of downed branches and trees as required, it does not place the responsibility for the identification and/or removal of hazardous trees into the hands of the user. Again, as these trails traverse extensive distances through natural areas, no specific program exists to monitor or remove hazardous trees and a level of risk must be assumed by users. Hazardous trees are targeted for removal, however, as part of regularly scheduled harvest operations which occur on approximately 15-year intervals in most hardwood stands. The operating plan will be modified to move forward the assessment and possible treatment of stands containing higher components of ash trees, high amounts of recreational use or designated trails, and in locations where the presence of EAB is imminent.

10.3 Management of Ash Trees along County Roads

Simcoe has recently completed an inventory for ash trees along its County roads (see section 9.3.2). Due to the rural nature of many of its roads, ash trees would only be required to be removed where they pose a hazard. It estimates that it has between 2,300 and 3,450 trees which would fall into this category. Felling these trees, chipping brush *in situ* and leaving large dimension wood for pickup or to decay would cost around \$200/tree, amounting to a total of \$690K.

10.4 Management of Urban Ash Trees by Local Municipalities

While Simcoe County does not assume costs for the management of trees owned or maintained by its local municipalities, it enjoys a good working relationship with and provides guidance to them with respect to managing IAS. To that end, three viable EAB management options (each with multiple permutations) have been developed and outlined for the possible use by local municipalities. A fourth option (Aggressive Management) sometimes recommended for municipalities well beyond what is considered to be the leading edge of the EAB infestation is not a practical option for Simcoe County or other southern Ontario communities due to limitations on survey and control, and the large number of ash in natural areas.

These options are the outcome of extensive analyses of EAB management programmes employed by EAB affected North American municipalities and reflect the latest science around EAB. The estimated costs associated with each option are based on a detailed cost-analysis which takes into consideration such parameters as: ash populations, projected mortality over a ten year period, and costs associated with tree removal, disposal, replacement and treatment. General management costs, such as project management and oversight, surveillance and monitoring, and communications are also included. These are best-guess estimates and are subject to numerous external variables such as the future impact that biological control organisms may have on EAB populations and the future availability and cost of effective pest control products. For these reasons, all estimates are based on 2013 costs.

10.4.1 Passive Management

This option treats ash trees the same as any other tree species and they would only be removed if they die or become hazardous. There would be no (or limited) surveys specific to EAB, no pesticide treatments of trees and limited public awareness activities. At the County level, there would be no replacement of ash removed along County roads or in County Forests. However, for urbanized, local municipalities, all street and park trees removed by the municipality would be replaced by caliper trees on a 1:1 basis, consistent with the municipality's urban forestry best management practices.

10.4.2 Active Management

The objective of this option is to preserve a percentage of the ash component of the canopy in urbanized local municipalities in the County. To this end, the County, in cooperation with participating municipalities would actively conduct surveys to detect pockets of infestation and prioritize areas for treatment and removal. There would be no actions taken by the County to preserve ash trees along its County roads or in its forests. Participating municipalities would have discretion over EAB management activities within their perimeters. All known infested ash trees within the boundaries of participating municipalities would be promptly removed. Apparently healthy trees not showing visible signs and symptoms would not be pre-emptively removed but would be assessed for possible treatment. To this end, municipalities would be required to develop rating criteria whereby candidate trees would be evaluated and prioritized for possible treatment. Preference should be given to larger street and park trees in good condition and apparently free from EAB and where ash is the dominant species along roadways. It would not be practical or even possible to treat all trees. Also, woodland trees cannot be cost effectively treated at this time.

While this document only deals with publicly owned trees, the County or its local municipalities may elect to provide private property owners with information on

protecting ash trees on their respective properties. Generally speaking, affected Ontario municipalities have not undertaken to pay for this.

Included as an appendix to this document are several examples of cost calculators (in Microsoft Excel format) developed by the author based on real-life examples from Ontario municipalities. To accurately predict costs for treatment, removal and replacement of urban ash trees over a specified period, accurate information must be input into the model. Based on information compiled by many Ontario municipalities affected by EAB, it is often cheaper to treat healthy trees in good condition over the initial 10 year period of an infestation than to cut them. This is especially true where the “true” value of a tree is taken into consideration.

For Active Management to be successful there needs to be an accurate and up to date street and park tree inventory which specifically locates publicly owned ash. Without this, it is very difficult to cost out the option or to coordinate removal and treatment activities. Survey activities are also recommended for the first few years of the management project as these help the municipality prioritize areas for treatment and removal.

10.4.3. Proactive Management

This option is fundamentally the same as **Active Management** with the exception that ash trees which have not been identified for treatment would be removed pre-emptively regardless of health or condition. The objective of this option is to limit the long-term impact to the canopy and get replacement trees into the ground as soon as possible. The basic premise of this option is that most untreated ash trees will die over the next five to ten years and those in urban situations should be removed as soon as possible in a cost-efficient, planned manner irrespective of their infestation status. To realize this, the County and participating municipality would conduct annual surveys to detect pockets of infestation in order to prioritize areas for treatment and/or removal and replacement. The pre-emptive removal of untreated trees would allow for some cost efficiencies and maximize opportunities for replanting and canopy recovery.

While the costs for implementing this option over a 10 year period are similar to those for **Active Management**, most of the cost is “front end loaded” because most untreated trees would be removed and replaced within the first five years. For this reason this option is usually more expensive when viewed over the initial five year period but is often cheaper in the long run. The primary benefit of this option is that it pre-emptively removes trees which are going to die in any event and allows for a head start on tree replacement and canopy retention/recovery. The drawbacks are the aesthetic and environmental impacts associated with rapid canopy loss, the difficulty in publicly defending the pre-emptive removal of seemingly healthy, symptomless trees and the

up-front costs associated with this. For this reason, few Ontario municipalities have gone this route.

11.0 COST ANALYSIS

The estimated costs of implementing three management options are presented below. In the absence of accurate data for Simcoe County and its local municipalities a generic model has been developed and the following assumptions are made based on data provided by other EAB affected Ontario communities. Bottom line costs are based on variables such as the total number of trees at risk from EAB, and the costs for treatment, disposal, stumping and replacement; these differ from municipality to municipality.

11.1 Assumptions for this model:

- # of urban **publicly** owned ash trees in parks and streets = 10,000
 - 8,000 street and
 - 2,000 park and cemetery trees
- Cost to remove, dispose, stump and replace an average sized ash tree is \$1,200²⁸ (this can be considerably more in some communities and less in others)
- Average cost to treat an ash tree with TreeAzin™ is 5\$/cm dbh. The average cost per 40 cm tree is calculated at \$200 every two years or \$100/year (this cost is standardized) per cm dbh
- Tub grinders are generally employed by municipalities with large volumes of large dimension wood (logs, stumps etc.) to dispose. They are capable of processing very large amounts of wood in a short period and for this reason they are often rented on a daily basis²⁹. Most municipalities find that they only need to use these one or two days per year. While relatively expensive at \$9,000/day, they would only possibly be required two or three days per year (\$18,000-\$27,000/year).
- Many larger communities have found it necessary to hire full or part-time project coordinators for the peak years estimated at \$80,000/year³⁰

²⁸ For trees on private properties, especially those in locations with limited access, costs are much higher and average around \$2,500 for a mature tree

²⁹ Despite their large size, and capacity, they are portable and easily transported to and installed at a disposal site

³⁰ This would include benefits, and operational costs associated with this position

- Survey and monitoring activities are required in support of most options; these are estimated at \$20,000/year for at least the first five years³¹
- Most communities opt to enter into a dialogue with affected stakeholders and need to build communications and outreach strategies. This is an additional cost and has been estimated for the purpose of comparison at \$10,000 for at the first five years
- Hazard tree removal in publicly owned woodlands and natural areas (where applicable) is estimated at \$10,000 year but can vary significantly
- Replanting and naturalization of natural areas (where applicable) is estimated at \$50,000/year (this too, varies considerably from municipality to municipality)
- For the purpose of comparison, it is assumed that all treated trees³² will survive for the initial 10 year period and that all untreated ash will perish

Costs are based on scenarios specifically developed for Simcoe County using Microsoft Excel spreadsheets and can be modified for use by individual communities upon request.

11.2 Description and Analysis of Management Options

11.2.1 Passive Management

Description and Elements:

The primary tenets of this option are that most untreated ash trees in the municipality are going to die over the next 10 years and that there is limited merit in attempting to preserve them with pesticide applications. Publicly owned ash trees would be treated the same as any other tree genus. They would receive no special consideration for conservation or protection and would be removed where they are deemed to be hazardous or an obstruction.

- No surveys specific to EAB would be conducted by the municipality
- No EAB control actions would be undertaken by the municipality
- Tree replacement would be consistent with existing protocols and policies
- Communication and public education activities specific to EAB would be minimal

PROs:

- Clear, straight-forward and easy to understand and communicate
- Proactive spending on EAB would be kept to a minimum and upfront costs would be minimal

³¹ In addition to the cost of purchasing and deploying traps and lures, this figure also includes planning, data analysis and associated management costs

³² Natural annual mortality for urban trees is usually estimated at ~ 2%. This includes abiotic factors as well as diseases and insects

CONs:

- A detailed analysis of costs associated with this option shows that it may be more expensive over a 10 year period than treatment depending on the number of trees selected for treatment³³.
- Where large numbers of trees have to be removed it is often more cost effective to do this proactively
- Reactive, rather than proactive. Dead trees soon become hazardous and have to be removed and affected communities run the risk of being overrun with large scale, non discretionary tree removal projects
- No ash trees would be saved with this option and ~100% of the municipality's ash would die within 10 years from the initial detection of EAB in the area
- This option provides for no mitigation of the anticipated environmental impacts associated with large scale urban tree loss. There would be an overall loss of biodiversity and as well, environmental degradation in parks, woodlands, and other natural areas.
- The absence of survey data would make it difficult to effectively plan for the efficient detection, removal and replacement of affected trees or to provide informed advice to property owners wishing to preserve trees on private properties
- There will be considerable aesthetic impacts. EAB infestation would result in the death of thousands of trees along streets and in parks, cemeteries and woodlands with concomitant reduction in property values

Discussion:

- Irrespective of which management option is selected, most of a municipality's untreated street, woodland and park and cemetery ash trees will die over a 10 year period and seriously impact the urban canopy. Little can be done to save woodland trees and this is unlikely to change.

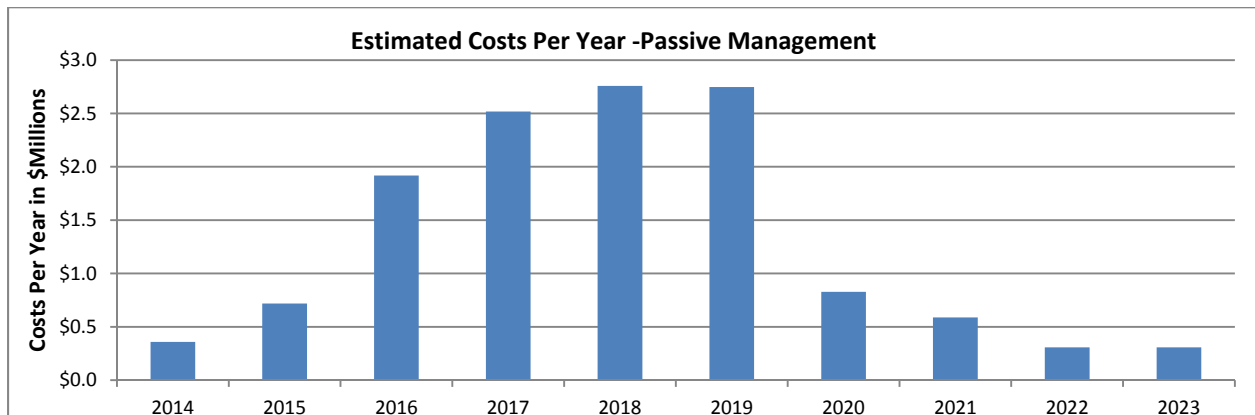


Figure 21: Estimated Costs for Passive Management (see 11.1 for values). No treatment, surveys or pre-emptive removals with this option

³³ For many communities removal, disposal and replacement costs exceed the cost of treating trees over the initial 10 year period

11.2.3 Active Management

Description and Elements:

The **tenets** of this option are:

- Maintenance of the overall percentage of the municipality's urban canopy
- Preservation of some urban ash trees (with priority given to areas where ash comprises the majority of street trees and removal would have significant environmental, fiscal and aesthetic impacts)
- Reduction on the impact to homeowners with publicly owned ash street trees

The **elements** of this option are:

- **Survey:** The municipality in cooperation with the County and the CFIA would conduct annual detection surveys to locate new and previously undetected infested sites. The tool of choice would be baited green prism traps in combination with visual surveys and branch sampling. At the municipality's discretion, delimitation surveys (using branch sampling) would be conducted around newly detected sites to determine their extent and assess the potential to effectively treat these areas). Surveys would become redundant and would be discontinued once EAB becomes pervasive (usually 5 years from initial detection);
- **Tree Removal:** Infested, moribund or at-risk street, park and cemetery trees as well as those adjacent to park and woodland trails and other public areas would be removed once they are determined to be infested. This would be done once signs and symptoms are manifested and ideally prior to the on-set of mortality thus allowing for more efficient management of the municipality's resources and reduction of risk and liability;
- **Replacement:** All ash street trees, where removed by the municipality, would be replaced on a 1:1 basis with non-ash. The municipality would develop an in-house policy for determining which park, woodland and cemetery trees need to be replaced. At its discretion, the municipality may elect to assist homeowners with replacement of ash trees on private property by offering incentives and discounts;
- **Treatment:** There is an opportunity to save a significant percentage of the urban ash canopy through treatment with registered pest control products such as TreeAzin™. This is especially important in areas with established ash trees, and ash monocultures. No trees in woodlands and natural areas would be treated
- The municipality would develop comprehensive **communications** and **public education** initiatives for both internal and external use

PROs:

- Research confirms that it is more cost-effective to treat healthy trees over the initial 10 to 15 year infestation period than to remove and replace them especially where the true value of an urban tree is factored in (e.g., urban heating, air and water quality amelioration, aesthetics and real-estate values)
- This option accepts the reality that most untreated ash trees in the municipality will die within the initial 10 year period and offers a sound, cost-effective alternative to doing "nothing" (Passive Management)
- When compared to **Passive Management**, this is a more pro-active and environmentally responsible approach to managing costs and resources and maintaining the **urban canopy**³⁴
- Annual surveys will permit earlier detection of outliers and will allow the Municipality to more accurately assess the impact that EAB will have, and develop timelines for treatment and removal.
- Prompt detection, treatment or removal of infested or at-risk trees will improve aesthetics and likely result in some efficiency of scale with respect to removal and replacement activities
- Treatment will maintain urban canopy and positively impact property values in some areas
- Additionally, effective public education and communication programmes will encourage private property owners to treat some trees which will help preserve the urban canopy and positively maintain

³⁴ This specifically applies to urban trees which can be treated effectively and not those in a woodland environment

their respective property values

CONS:

- Urban street ash are usually cultivars and/or nursery reared trees selected for aesthetic virtues and are not representative of the genetic makeup of the “wild” populations in the area
- Preservation of urban street, park and cemetery ash will provide little or no long-term mitigation of the environmental impacts or epidemiology of the current EAB outbreak
- It is uncertain as to how long trees must be treated to ensure protection against future EAB attacks. While the impact of EAB is expected to be attenuated at some point in the future by biological controls and other factors, it is difficult to predict when this will occur... costs for treatment may be on-going past the initial 10 year period. Over time, other natural, age-related mortality factors will become more important
- TreeAzin™ and other pest control products are not effective on infested trees and only healthy trees can be treated
- Treatment is very time sensitive and a rapid increase in the EAB population will quickly limit the number of trees which can be saved (for this reason, at-risk municipalities must act quickly)

Discussion:

- Active management has been selected by many Ontario communities as their **preferred option**. The objective of this option is to responsibly manage and potentially off-set the impact of EAB, rather than to try to manage the pest *per se*. It is a cost-effective, science-based and environmentally responsible approach and is compatible with current best management practices for many municipalities. To date, there is no cost-effective or practical way to preserve ash trees in woodlands and natural areas where it can be expected that most untreated ash will die within 10 years resulting in heavy environmental impacts to areas with significant numbers of ash, a loss of biodiversity and a permanent loss of genetic diversity for genus *Fraxinus*.

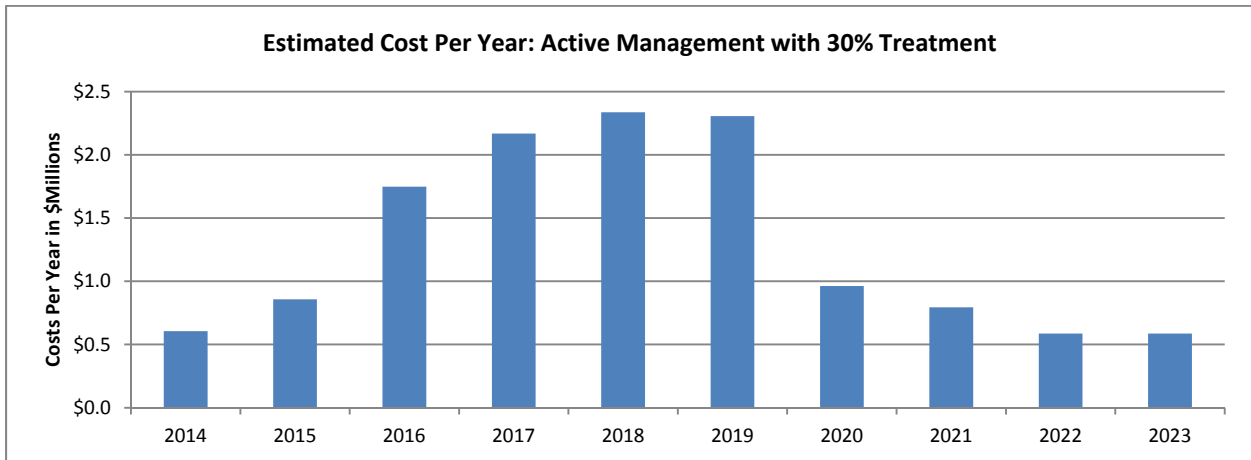


Figure 22: Active Management where 30% of publicly owned street, park and cemetery trees are treated; only dead or dying trees are removed

11.2.4 Proactive Management

Description and Elements:

The primary tenet of this option is that most untreated ash trees in the municipality are going to die over the next ten years and should be pre-emptively removed as cost-effectively and quickly as possible to allow for replacement trees to be planted and the canopy to recover; removal would be irrespective of infestation status and symptomless trees would be removed.

- As with the **Active Management** Option **Detection and Delimitation Surveys** would be conducted in order to detect hot-spots and prioritize areas for removal or treatment
- No woodland trees would be treated
- The municipality would remove a minimum 20% of its untreated ash trees per year over the initial 5 year period
- Tree replacement would be high priority and coordinated with tree removal activities
- Communications, outreach and public education initiatives would be paramount as many areas of the municipality would be aesthetically compromised as a result of the removals
- While staged removal and replacement of vulnerable ash trees would be the prime directive, protection of high value street trees with TreeAzin™ is a key element of this option

PROs:

- Most treated trees should survive the current EAB epidemic
- Notwithstanding, this option accepts the reality that most untreated ash trees in the municipality will die over the next 10 years and allows the municipality to accurately forecast and budget for costs associated with EAB management and tree replacement over this period
- Detection and delimitation surveys during the first five years of the project will permit early detection of outliers and allow for prioritization of tree removal and replacement
- Prompt detection and removal and replacement of infested or at-risk trees will improve aesthetics and should result in cost efficiencies
- The emphasis on tree replacement will allow for the canopy to recover faster than with other options (this is the primary selling point of this option)
- Over a 20 year period, this is considered by many to be the most prudent option from a fiscal and environmental perspective

CONs:

- To be effective, this option must be implemented early in the infestation
- This option requires that some apparently healthy trees be pre-emptively cut. This is a “tough sell” and may be hard to defend to affected property owners, city councillors and the media (even though it is a bona fide and cost effective strategy)
- Costs are front-end loaded with most activity being within the first five years; see above

Discussion:

- This is a viable option, especially if you look beyond the initial five year treatment window. Data are now available for several Ontario and US municipalities to show that it is cheaper over the initial 10 year period to treat trees rather than cutting them; this is especially true when you factor in the total value of a tree with respect to its benefits to the urban environment (such as reduction in urban heating, improving storm water quality, wind abatement, real estate valuation etc.). Moreover, treating street trees can be cheaper than removing and replacing them over an extended year period. While TreeAzin™ is considered to be an expensive product, its price has dropped significantly in recent years. Should cheaper products with efficacies similar to that of TreeAzin™ come on the market in the future, this will make treatment an even more attractive and cost-effective option over a 15 and ever 20 year management period. This option is very time sensitive and action must be taken immediately by affected municipalities upon discovery of EAB if some urban ash trees are to be saved

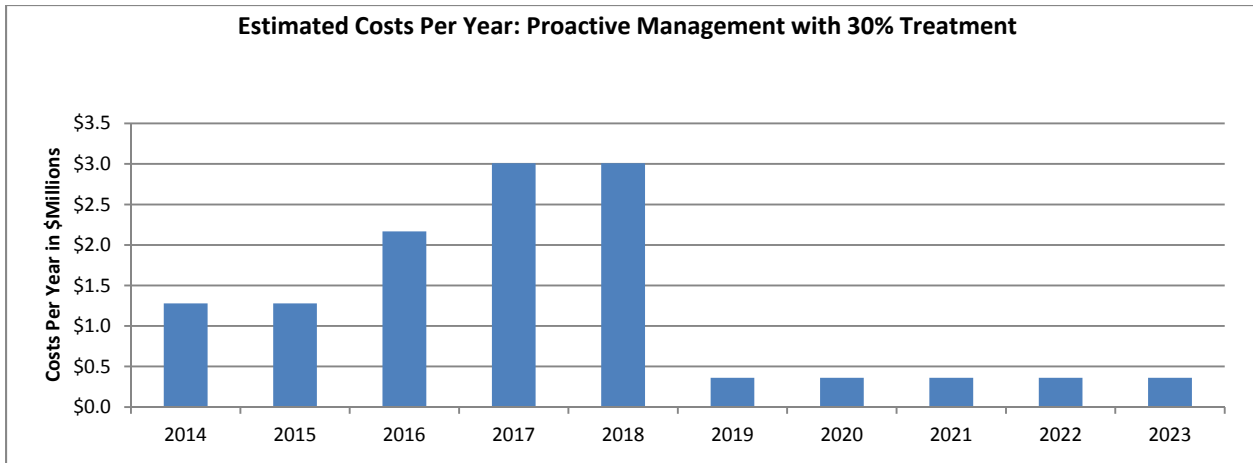


Figure 23: Proactive Management where 30% of street, park and cemetery trees are treated and the remainder pre-emptively removed over the initial 5 year period

11.3 Management Options Cost Comparisons

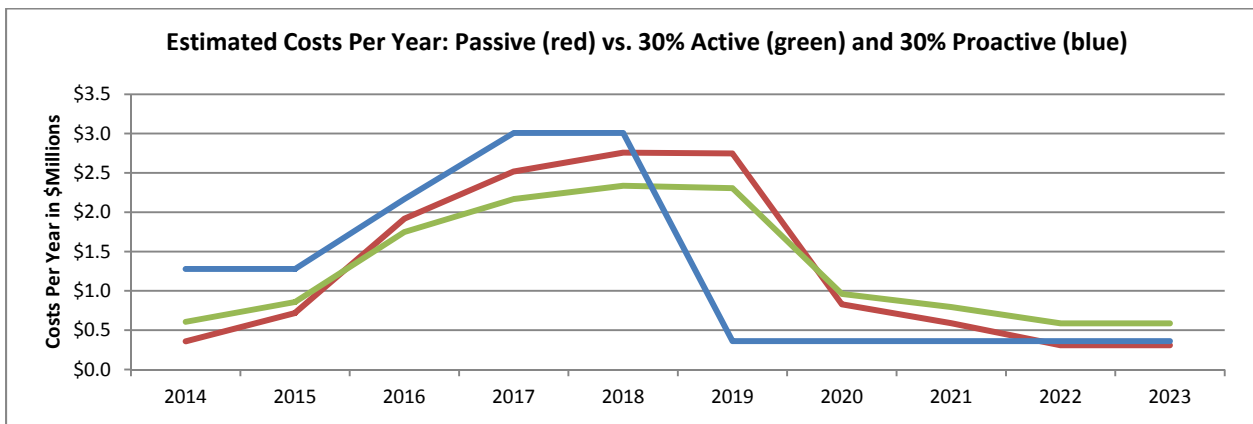


Figure 24: A comparison of estimated costs per year over a 10 year period for 3 Options: Passive vs. Active and Proactive Management (where 30% of trees are treated with TreeAzin)

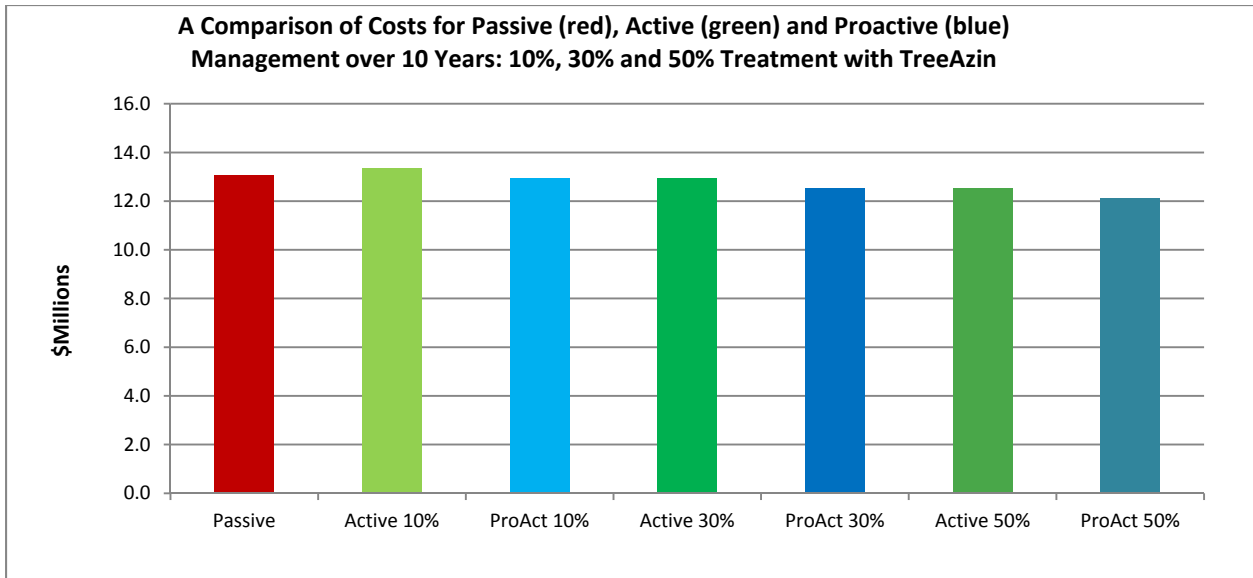


Figure 25: A comparison of estimated costs per year for 3 Options over a 10 year period: Passive (no treatment), Active and Proactive Management at 10%, 30% and 50% treatment rates with TreeAzin)

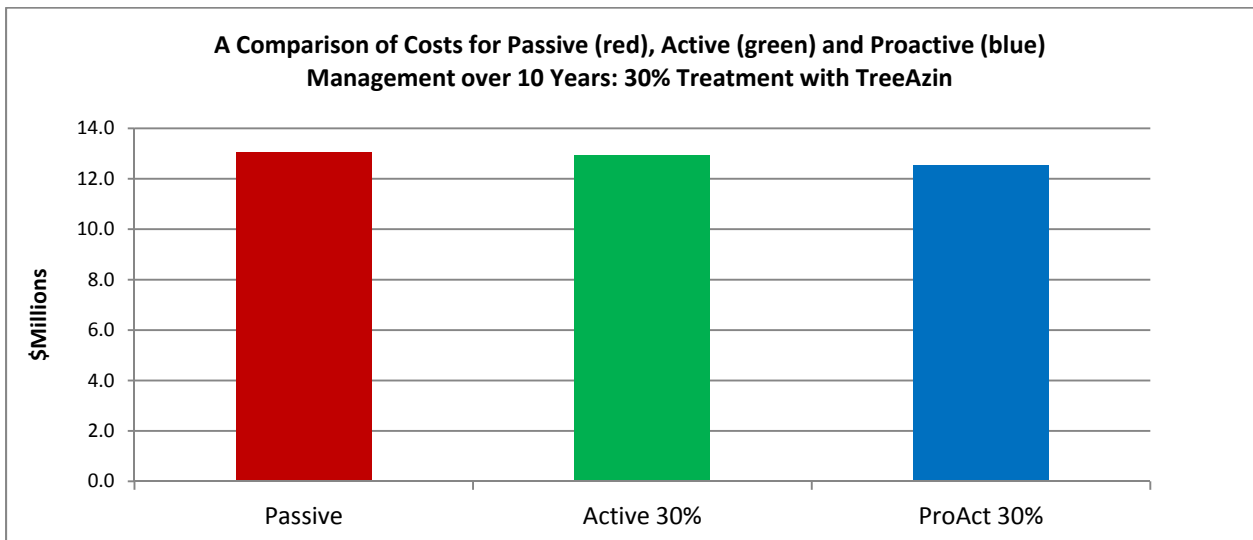


Figure 26: A comparison of estimated costs per year for 3 Options over a 10 year period: Passive (no treatment), Active and Proactive Management (where 30% of trees are treated with TreeAzin)

12.0 RECOMMENDED OPTION

12.1 Preamble

In consultation with Simcoe County, **Passive Management** is recommended at the County level as the preferred option. There should be no attempt to prevent the death of woodland trees as a result of EAB and ash trees along County roads should either be removed pre-emptively or allowed to die and then felled and removed where they pose hazards or obstacles. The County will undertake hazard identification of roadside trees in 2014 and pre-emptive removals will be initiated in representative areas of the County in 2014. On the basis of these, the County will be better able to prepare more detailed budgets and/or strategies for 2015 and beyond.

No attempt should be made to replace trees in County Forests; exceptions may be made for some areas with high percentages of ash where the natural succession of the forest may be threatened by IAS and intervention is necessary. Site remediation may be considered for areas where large numbers of ash have died. This may include the removal of invasive alien plants such as buckthorn and dog-strangling vine and may entail replanting with suitable species. At present, Simcoe Staff are not aware of any situations which would warrant site remediation within the County Forests.

The County has no plans to replace or treat ash trees along its County Roads nor will it undertake to financially assist local municipalities in replacing or treating ash trees along urban sections of County Roads.

The County should continue with its current policy of partnering with non-profit groups including snowmobile, ATV, and off-road motorcycle associations, hiking trail associations, and mountain bike clubs to map, mark and maintain trails in its County Forests. The County should continue to target hazardous trees for removal as part of regularly scheduled harvest operations (which occur on approximately 15 year intervals in most hardwood stands). This schedule may be amended for stands containing higher components of ash trees, high amounts of recreational use or designated trails, and in locations where EAB is present or imminent.

12.2 Rationale supporting Decision:

As most of its ash trees are in woodlands, there is no practical or cost effective way of treating them with pest control products and pre-emptive cutting is unlikely to slow the intracounty spread of EAB or to off-set any long term economic and environmental impacts. For these reasons, ash trees should be allowed to die without intervention and

should only be removed where they are deemed hazardous. Furthermore, the relatively low percentage of ash in County forests would likely make salvage logging operations unprofitable unless other species were removed at the same time or compensation or other financial incentives were provided by the County. The County should continue to include this element in logging prescriptions for County forests. The costs associated with managing EAB affected woodland trees are expected to be minimal.

12.3 Management of EAB in Urbanized Local Municipalities

A stated objective of this report is to provide a template for Simcoe's local municipalities which may wish to develop and enact EAB management plans.

As previously mentioned, it can be cost effective and beneficial for urbanized local municipalities to preserve some of the ash component of their urban forests, especially street, park and cemetery trees. To this end, many southern Ontario municipalities have developed EAB management plans in recent years and have successfully treated and saved a significant percentage of ash trees in their urban canopy.

For management to be successful, certain criteria should ideally be met by the municipality up front. These are:

- The existence of a strategic action plan (management plan) stating what the objectives are, how these will be met, and by whom;
- The ability to conduct detection surveys to provide for early warning of EAB presence and to focus EAB management activities;
- Up to date GPS based inventory data for urban trees showing the number, location, health and condition of publicly owned ash trees;
- An understanding by senior management and municipal councils that:
 - EAB management is a long-term commitment and that continued funding will be required (10 years is the norm);
 - regardless of the option selected, there will be significant expense incurred by the municipality regardless and “doing nothing” can often be most expensive option in the short and long term;
- An accurate up-front costing of EAB management activities. These vary from municipality to municipality and affect the bottom line of any management programme. Costing models using Microsoft Excel spread sheets have been developed by the author for this purpose; accurate costs are required with respect to:
 - removal,
 - stumping,
 - disposal,

- replacement,
- project oversight and management
- Tree selection criteria specific to the municipality (it is not practical or even possible to treat all trees... what criteria will you use to select trees for treatment?). This often takes on political overtones and municipal foresters have to defend their decision with “facts”;
- Communication and outreach strategies. Public education and support are paramount to the success of any municipal EAB management programmes

It is recommended that local municipalities in Simcoe wishing to treat trees for EAB plan to do so for 2014. EAB populations soon reach epidemic levels after the initial detection thereby making management programmes very time sensitive.

13.0 ACTION PLAN

13.1 Monitoring and Surveillance

13.1.1 Objectives

1. Conduct **Detection Surveys** at key locations around County including local municipalities
2. Conduct **Delimitation Surveys** around detected infestations to determine dispersal, distribution and degree of infestation.

13.1.2 Activities

Activities to Meet Objectives	Simcoe County	Local Municipalities
<ul style="list-style-type: none"> ● Deploy prism traps at strategic locations throughout the County in densities sufficient to provide statistical confidence that EAB is NOT present in an area ● Branch sampling where EAB detected ● Visual surveys for signs and symptoms such as crown decline ● Analyse and map data 	<p>The County is willing to coordinate surveys if requested to do so by the local municipalities; intensity TBD through consultation. See estimated costs.</p>	<p>TBD</p>

13.1.3 Cost (Financial Forecast)

Traps cost from \$30-\$50 per unit depending on the lure used. Simcoe County plans to deploy 50 traps throughout the County on an annual basis until such time as the County is deemed generally infested. This is expected to be for the initial five years of the infestation (2018). It takes, on average, four person hours to install, check and collect the traps for a total of 200 person hours. It is estimated that this will cost **\$6,500** per year. This figure does not include planning, training, data analysis, GIS, and related management costs which have been estimated by the County to bring the true cost of conducting detection surveys to around \$20,000 per year.

13.1.4 Comments

EAB has been detected in the southern part of Simcoe County and is likely established at other locations. It will continue to spread as a result of natural dispersal and human activities regardless of an intervention. EAB spreads rapidly around outliers and is likely to be widespread throughout the County within five years. Once this has happened survey related activities will become redundant and can be discontinued. In the interim, accurate inventory and survey data are paramount with respect to making informed management decisions around EAB. Early detection of EAB outliers will allow for targeting of tree protection, removal and replacement initiatives and will help the County and its local municipalities estimate future costs for these.

13.2 Tree Protection

13.2.1 Description

With specific respect to EAB, tree protection means treatment with registered pest control products to prolong the life of a tree that would otherwise be killed by EAB. It is anticipated that without intervention, close to 100% of Simcoe County's ash trees will be killed over the next 10 years. There are now data to show that the timely application of pest control products such as TreeAzin™ can effectively save at-risk trees and that over a 10³⁵ or even a 15 year period treatment can be less expensive than removing urban trees. Under the terms of registration for this product, it may only be applied by certified applicators using the EcoJect® system under patent to BioForest Technologies Inc. This is the only pest control product recommended in Canada at present for the management of EAB.³⁶

The use of pesticides would be limited for the most part to the protection of street, park and cemetery trees in good health and condition by local municipalities. There would

³⁵ Recent research by CFS suggests this period is at least 15 years when the true value of a tree is factored in.

³⁶ While both ACECAP® 97 and Confidor 200SL are currently registered in Canada by the PMRA they are not recommended by the OMNR, CFS or the author as effective pesticides against EAB

be no attempt to preserve woodland ash trees, those in natural areas and along County roads.

Irrespective of actions taken by the County or its local municipalities, private property owners may opt to treat high value ash on their respective properties and they need to be provided with informed advice in this regard. Only products legally registered for use in Canada may be used against EAB. At present, all three products currently available in Canada may only be applied by a licensed pest control operator.

13.2.2 Objectives

1. Detect and determine extent of EAB populations in Simcoe
2. Develop selection criteria for trees to be protected
3. Select and map trees for treatment
4. Conduct cost benefit analysis: treatment vs. non-treatment
5. Communications and Outreach

13.2.3 Activities

Activities to Meet Objectives	Simcoe County	Local Municipalities
<ul style="list-style-type: none"> • Conduct Detection and Delimitation surveys • Map infested areas <ul style="list-style-type: none"> • Provide data to public via website • Develop criteria for selecting trees to be treated • Identify, prioritize and map candidate trees/areas • Develop operational plans for treatment <ul style="list-style-type: none"> • Determine costs and extrapolate over 5,10, 15 and 20 year periods • Public meetings and open houses where applicable 	<p>The County is willing to coordinate surveys. Intensity and participation by local municipalities is <i>ad hoc</i>. TBD</p>	<p>TBD</p>

13.2.4 Cost (Financial Forecast)

There will be no costs incurred by the County for Tree Protection *per se*. Detailed spreadsheets have been developed in conjunction with this report to help interested local municipalities in calculating costs associated with tree protection and other management activities.

13.2.5 Comments

- Non-infested urban ash trees in otherwise good health can be cost-effectively protected for at least 10 years if treated early enough (prior to EAB population buildup in the area)

- It is recommended that any EAB action plans developed by local municipalities clearly outline how the municipality will select trees for treatment. To this end, the municipality needs to develop clear criteria to select and rate candidate trees
- No attempt should be made to treat or otherwise protect woodland ash trees

As of October 1, 2013, the average cost for treatment with TreeAzin™, is around \$5 per cm dbh every second year for commercial applications. In heavily infested areas where trees may already be infested at sub-detectable levels or where beetle populations are already high, the distributor (BioForest Technologies Inc.)³⁷ is now recommending that applications be made for the first two years of treatment and every two years thereafter for the initial 10 year period.

13.3 Removal and Replacement

13.3.1 Description

Removal refers to cutting ash trees as a direct result of current or impending EAB infestation. Removal may entail:

- Felling the tree *in situ* without removal from the area
- Removal of the branches and trunk of the tree (leaving the stump)
- Total removal of all parts of the tree including stumps
- Chipping, grinding, slabbing and/or burning either on site or at the disposal site (which may or may not meet prescribed specifications to kill all life stages of EAB)
- Salvage logging in woodlands³⁸

This can be done in the context of:

- Hazard tree removal by the municipality (removing those trees which are, or will become hazardous along county roads, streets, or adjacent to woodland trails) or, the ordering of private property owners to remove hazard trees under the Town's Property Standards By-law
- Pre-emptive removal (removing trees prior to infestation and/or death, regardless of apparent health status)
- Selective tree removal (removing specific trees in conjunction with an over-all management programme to limit or mitigate EAB impact)
- Salvage logging of woodland areas likely to be heavily impacted by EAB
- Other... such as the pre-emptive removal of trees as part of a woodland management programme (irrespective of EAB status)

³⁷ Personal Communication, Joe Meating, BioForest Technologies INC

³⁸ Salvage logging of roadside, park and street trees is not generally an option due to the condition of these trees and the reluctance of forestry companies to accept these logs due to metal inclusions and other factors

Replacement refers to the planting of non-host³⁹ species of trees to replace urban ash trees which have been removed as a result of current or impending EAB infestation.

This component entails the replacement of trees which have died or have been removed (specifically for EAB) by a municipality. For all street and park trees which are removed, a caliper size tree is planted (where conditions permit). Costing formulae used in this document reflect this assumption.

In some cases, site remediation is necessary, especially where large numbers of ash trees have died and/or where there has been physical damage to the site through erosion or removal activities.

13.3.2 Objectives

1. Identify and determine the number of publicly owned street, park and cemetery ash trees
2. Identify and determine the number of potential hazard trees along pathways and trails in parks and woodlands
3. Identify street, park and cemetery trees to be removed
4. Develop an action plan for replacing urban trees killed by EAB
5. Evaluate the potential for salvage logging in woodlands where applicable
6. Develop site-specific ash tree removal and replacement policies, prescriptions and protocols)
7. Cost Analysis (specific to removal and replacement activities)

13.3.3 Activities

Activities to Meet Objectives	Simcoe County	Local Municipalities
<ul style="list-style-type: none"> • Inventory street, County Rd, park and cemetery trees • Conduct woodland inventories and site assessments • GPS or otherwise map • Conduct inventory of potential hazard trees along woodland trails and pathways • Categorize as to risk potential • Develop protocols for removal • Develop or procure list of suitable replacement species • Determine schedule for replacement • Issue contracts consistent with current policy • Environmental impact assessment where required? • Establish per unit costs for removal, replacement and disposal • Site remediation considerations where applicable 	<p>Roadside inventory complete.</p> <p>Simcoe has developed a policy for dealing with hazard trees along County roads.</p> <p>Roadside trees will not be replaced by the County.</p>	<p>TBD</p>

³⁹ See definition

13.3.4 Cost (Financial Forecast)

Simcoe County has recently conducted a preliminary inventory of its roadside ash trees and has estimated costs of **\$690,000** for felling and removal of these. Local municipalities have yet to determine their costs but these would be borne by the local municipality rather than the County *per se* in any event.

13.3.5 Comments

Standing dead ash trees decay rapidly and often become hazardous within two years after death. In order to limit liability to a municipality, publicly owned street or roadside trees which pose a hazard need to be removed prior to, or immediately following death. Woodland trees killed by EAB generally do not have to be removed (or felled) unless they are close to roads, public pathways or trails or are otherwise deemed a hazard. Large numbers of dead trees pose an added complication as they can make the woodland unsafe to work in and add to the overall cost of removal.

Irrespective of the management option selected by a municipality, the removal of hazard trees is non-discretionary due to the inherent liability associated with leaving standing dead trees. For this reason, there needs to be a contingency plan for dealing with dead or dying trees prior to the onset of mass mortality predicted to occur within the next five years. Where removals are pre-emptive, they can be staged over a multi-year period based on risk and efficiency of removal. Annual detection and delimitation surveys will help quantify these criteria.

In light of the risk posed by EAB, Simcoe County has developed a policy dealing with dead trees (including ash) along roadway maintained by the County. Where dead or dying trees along County roads are felled, the closest landowner will be contacted to determine if they want the wood (generally for firewood purposes) which is usually the case. Simcoe staff will remind the landowner that the wood should be burned locally and not transported elsewhere in order to reduce the risk of EAB being moved long distances. Where the landowner does not want the wood, it will be collected and transferred to the nearest disposal site for treatment there.

There are no plans by the County at present to treat or replace roadside trees removed as a result of EAB.

13.3.6 Recommended Actions:

- Assess risk for public trees
- Using survey data, predict where mass mortality is likely to occur
- Prioritize sites for imminent removals and/or treatment
- Develop a replacement strategy
- Develop a strategy for dealing with hazard trees on private properties

- Develop communications and public outreach programmes

Having a management plan in place allows municipalities to plan and focus removal, and replacement activities and to budget accordingly. Most Ontario municipalities see urban tree replacement as a non-discretionary activity and have committed to maintaining or increasing the relative percentage of their urban canopies; many have developed Strategic Urban Forest Management Plans to provide a framework for this.

13.4 Restoration and Remediation

13.4.1 Description

The **Restoration and Remediation** component entails repairing or otherwise mitigating damage to woodland, riparian or other natural sites which have been severely impacted by EAB and making them suitable for tree replacement or natural succession by desirable species. While not always necessary, site remediation may be required where large numbers of ash trees have died and/or there has been physical damage to the site through erosion or removal activities. The presence of significant numbers of invasive alien species such as European buckthorn, dog-strangling vine garlic mustard and autumn olive in the understory is an aggravating factor and could jeopardize natural succession in these areas.

13.4.2 Objectives

1. Mitigation of environmental and ecological impacts of EAB infestation in natural areas and County forests
2. Management of hazard trees along pathways and trails in natural areas

13.4.3 Activities

Activities to Meet Objectives	Simcoe County	Local Municipalities
<ul style="list-style-type: none"> • Develop an accurate, up-to-date tree and land use inventory • Develop or build on existing criteria or protocols governing site restoration for natural and woodland areas • Collaboration with partners such as: Provincial and Federal governments, conservation authorities and private tree planting groups • Identify particularly sensitive areas where ash plays a vital role in the ecology of site (e.g., riparian areas where sedimentation or degradation of in water quality may result from mass mortality) • Develop a plan to mitigate damage to these sites (this 	<p>Complete for the most part. Roadside and woodland trees will not be replaced.</p> <p>No remediation activities are indicated or planned at this time by the County.</p>	<p>TBA</p>

<p>may include underplanting with non-host species in some instances, construction of berms etc.)</p> <ul style="list-style-type: none"> • Integrate existing strategies for IAS into remediation action plan • Hazard tree removal along woodland trails 		
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13.4.4 Cost (Financial Forecast)

There are no anticipated additional costs for this element to the County.

13.4.5 Comments

While ash is an important component of many of Simcoe’s County forests, the overall impact associated with canopy reduction is not likely to be as severe as with other Ontario communities where ash represents a much higher percentage of the trees. Notwithstanding, various species of ash are a vital component of the ecosystems of some environmentally sensitive sites such as wetlands and riparian areas and their loss could have significant and lasting impacts on these areas. Additionally, the loss of ash could greatly degrade vulnerable habitats through increased erosion, sedimentation, and stream warming as well as the loss of browse and habitat for animals. Furthermore, these areas would also be more vulnerable to colonization by invasive alien plant species.

Simcoe County and its local municipalities need to identify which areas will be most impacted by EAB and develop strategies to minimize or mitigate the damage.

Depending on the site, these could include:

- Protection
- Provision of replacement trees (at subsidized or reduced cost) to private property owners
- Underplanting severely impacted woodlands with non-host trees
- Selective removal of IAS plants
- Physical alterations to environmentally sensitive sites to prevent or counteract erosion and degradation of water quality

13.5 Disposal

13.5.1 Description

Disposal is often a separate activity from **removal** for most municipalities. While many smaller urban trees can be chipped on site, this is not possible for larger dimension materials which must be cut into logs and transported to a disposal site (often at considerable cost). Disposal may entail:

- storage without processing
- processing and recycling (lumber, firewood and mulch etc.)
- chipping and grinding to compliance standards (<2.5 cm in any two dimensions)
- Other... deep burial, burning, novelty uses

13.5.2 Objectives

1. Estimate the economic and environmental impact of removal activities on the community
2. Ensure current disposal protocols are adequate to meet demand
3. Ensure landfills are prepared to accept the anticipated volume of dead ash trees
4. Budget for increased disposal activities
5. Investigate “green” options for disposal such as salvage logging, biofuels, diversion etc.
6. Provide information to private property owners
7. Ensure appropriate messaging is provided to people moving potentially infested materials

13.5.3 Activities

Activities to Meet Objectives	Simcoe County	Local Municipalities
<ul style="list-style-type: none"> • Using surveys, UFORE and other inventory tools estimate the number and size class of at risk roadside, street, park and cemetery trees • Determine capacity of landfill sites and recycling stations to receive ash wood products • Establish ash drop off centres in urban areas • Develop policies for collection and disposal of possibly infested urban forest materials • Explore alternate uses for ash products • Develop Communications and public outreach programmes for affected property owners • Develop a policy for disposal of woodland trees 	<p>Completed</p> <p>Completed</p> <p>In Progress Completed</p> <p>In Progress</p> <p>In Progress (Feb. 2014)</p> <p>“ “</p>	<p>TBD</p>

13.5.4 Cost (Financial Forecast)

Simcoe County appears to be well positioned to deal with the large number of trees expected to be killed by EAB over the next 10 years. The County currently has eight disposal sites at which residents, tree service companies and municipalities can drop off ash materials free of charge. Costs can be recovered through the sale of wood chips. Logs received at the sites are cut into firewood dimension for pickup by interested parties.

The County currently has a high capacity horizontal grinder which can process up to 30 tonnes of wood products per hour and would normally operate eight hours/day. This grinder is portable and is moved between the eight disposal locations on an as-needed basis. It currently costs \$14/tonne to dispose of wood waste, which equates to \$377/hour or \$3,016/day. If necessary, operating hours can be extended to deal with increased volumes of dead trees. While it is not possible to calculate the additional costs which will be incurred by the County for disposal of ash materials, this is not anticipated at present to be a major budget pressure. Simcoe County does not currently accept wood materials from either Barrie or Orillia which are separate municipalities with their own disposal sites.

13.5.5 Comments

The disposal of trees killed by EAB can be problematic for affected communities. EAB usually reaches epidemic levels within five years of its initial detection in an area and municipalities with large numbers of ash can be physically and fiscally overwhelmed.

The movement and storage of infested materials can greatly increase the risk and rate of spread. Leaving large amounts of unprocessed infested ash materials has been shown to exacerbate the situation by allowing large populations of EAB to build up and disperse more rapidly than what would otherwise be expected.

While “green” disposal and recycling of ash wood waste is desirable, few municipalities affected by EAB have been successful in their efforts to salvage or recycle these materials; the very large volumes and the limited market for such products as wood chips greatly limits the options available. Furthermore, there is great reluctance on the part of many sawmills to accept urban logs for processing. This is often because of the likelihood that logs will contain metal inclusions that can seriously damage saw blades or pose as a hazard to sawmill workers. Metal inclusions can be remnants of old fences, nails, and bullets etc.

Lastly, there is little interest on the part of many urban loggers to pre-emptively remove the ash component of many urban woodlots due to the relatively low percentage of ash in these areas, and the difficulty in doing this for a profit. While there is no hard and fast rule for this, there generally has to be at least 10% mature ash in the woodlot, and unfettered access to make selective logging a profitable venture.⁴⁰

Simcoe County is prepared for the influx of ash materials to its disposal sites. It is currently training its staff at disposal sites to differentiate ash from other trees species and to separate these out from materials available to the public for use as firewood. As well, literature will be provided to persons picking up firewood, encouraging them to burn it locally and not transport it long distances.

⁴⁰ Ken Elliott, OMNR, Feb 2012

13.6.5 Comments

A sound **Communications** strategy is required regardless of which management option is selected by the County and its local municipalities. Ensuring that senior management, elected municipal officials, the public and media are educated with respect to the expected impact of EAB and are onside with efforts to deal with it are paramount and integral to success.

14.0 SUMMARY

EAB has behaved as a classic, albeit, worse case example of an invasive alien pest to this point. Many of the dire predictions made by scientists soon after its discovery in 2002 have proven very accurate and it is ranked as one of the worst pests to ever be introduced to this continent.

EAB has had and will continue to have serious economic and environmental impacts and costs for removal and disposal of dead trees could easily reach into the billions of dollars in future years in Canada. Additionally, much of the genetic diversity of ash in Canada and the US (the result of millions of years of evolution) will be lost forever, greatly affecting the ability of this genus to rebound from EAB or adapt to future challenges. Ash-based ecosystems will continue to be seriously compromised and IAS “weeds” such as dog-strangling vine, autumn olive, honeysuckle, garlic mustard, buckthorn, and privet, will become even more serious and pervasive pests in years to come as the niche ash previously occupied is encroached upon by these species.

The good news is that, IAS rarely sustain their epidemic phase and it is likely that EAB populations will crash or at least come into balance with their host at some time in the future with an ecological equilibrium being reached. Research conducted by both US and Canadian scientists has confirmed that EAB can only survive on ash and there is no indication to this point that it will ever jump to other species with the decline of ash populations in eastern North America. In the long term, existing ash trees which are genetically predisposed for resistance to EAB will survive and be naturally selected and will play an increasingly important role in the recovery of the genus.⁴¹

In recent years, both the CFS and the USDA and its co-operators have released exotic parasitoids⁴² collected in eastern Asia and specific to EAB at numerous US sites in the hope that these will become established in North America and ultimately effect some

⁴¹ Resistant trees have not been observed to date in significant numbers

⁴² See definition

degree of control. At present, this appears to have been a qualified success with there being evidence that all three species released in the US have successfully established and this strategy is now a central tenet of the US management programme. Combined with the observed emergence of several native species of hymenopterous parasitoids (parasitic “wasps”) which naturally attack North American relatives of the EAB, there is a likelihood that EAB populations will be impacted by these agents in the future and perhaps even be brought into balance.

Of note, is that effective pest control products are now available in Canada and the US and it is now possible to cost-effectively treat and preserve some ash trees in the urban canopy. Along with significant improvement in survey technology, this is seen by many forest pest management specialists as a “game changer”, and gives municipal foresters an option they did not have a few years ago. New (and less expensive) products will make the preservation of urban ash even more cost effective in years to come. Unfortunately there is little hope that many woodland ash trees in most of southern, central and eastern Ontario can be saved as it is not practical to treat woodland trees at the present time and many have already succumbed to EAB.

With specific reference to Simcoe County and its local municipalities, there is no expectation that EAB can be eradicated or even managed locally. EAB population levels are likely to increase exponentially over the next five to ten years and infest and kill most of the untreated ash trees in the area. There will be severe and lasting environmental, aesthetic and economic impacts on the County, its local municipalities, industries and property owners. Irrespective of the management option selected, dead trees are often hazardous and will place urbanised local municipalities in a position of liability if not promptly removed. For this reason, local municipalities will be obligated to remove street and park trees killed by EAB, as well as those adjacent to public trails in their natural areas and will likely incur significant costs to do this.

This report does not deal with trees on private property. Generally speaking, these exist in similar numbers to publicly owned trees and property owners with ash trees will be heavily affected. Dead trees will have to be promptly removed in order to prevent property damage and reduce the risk of liability and the loss of large shade trees has been demonstrated to adversely affect property values in urban areas. While the County and its local municipalities are aware of, and sensitive to this issue, there is no obligation on their part to financially assist affected property owners.

Despite the severity of EAB, maintaining healthy streetscapes and woodlands is integral to the health of the urban environment and every effort must be made to maintain or even increase the number of healthy trees in urban and adjacent rural areas through visionary management, public education and replanting programmes.