Town of Hartford VT Ash inventory and Emerald Ash Borer (EAB) Preparedness Executive Summary, January 22, 2014

James B. Goedkoop, Town of Hartford VT Tree Warden, Team Leader, EAB preparedness plan.

Description: Since discovered about 10 years ago, the invasive pest, EAB has spread across the Eastern US from Michigan and is now present in states bordering Vermont. This insect will inevitably destroy most, if not all, ash trees not protected by routine insecticide treatments. This summary describes the scope of the threat to public property and recommendations to mitigate the impact of the EAB.

Ash Tree Inventory

Village (WRJ, Wilder, Hartford, Quechee, West Hartford) public ash trees total 63 trees				
(all reported in good condition, 63 trees)				
tree size DBH (diameter in inches at breast height)	1-6"	6-12"	12-18"	18+"
no. of trees by size class	26	22	6	9
none reported as utility conflict, survey did not assess road hazard potential				

Roadside/ROW (right of way public corridors for roads and utility lines) ash trees total 1778 trees				
ash in poor condition (196 trees)				
tree size DBH	1-6"	6-12"	12-18"	18+"
road hazard* total 80 trees, no. of trees by size class	11	45	16	8
utility hazard** total 116 trees, no. of trees by size class	12	65	27	12

ash in average condition (284 trees)				
tree size DBH	1-6"	6-12"	12-18"	18+"
road hazard* 145 trees, no. of trees by size class	33	54	45	13
utility hazard** 139 trees, no. of trees by size class	12	78	33	16

ash in good condition (1298 trees)				
tree size DBH	1-6"	6-12"	12-18"	18+"
road hazard* 658 trees, no. of trees by size class	137	266	196	59
utility hazard** 640 trees, no. of trees by size class	69	337	161	73

* trees presenting a road hazard alone
** tree presenting both a hazard to road and utility lines
(there were virtually no trees presenting a hazard to utility lines alone)

Summary & Recommendations:

1) Of the 63 Village ash trees, those of high cultural and public value should be identified by the Tree Warden, Tree Board and Parks & Recreation Dept. to plan for preventative measures. Protection can be accomplished with botanical insecticides. TreeAzin® for example ia a systemic insecticide produced from Neem tree seeds, is registered by the US EPA and listed by the Organic Materials Review Institute for use in organic crops and is effective against EAB. While TreeAzin® is not yet registered for use in Vermont, it is anticipated that a similar or alternate pesticide will be available.

2) The Tree Board, Tree Warden, Parks & Recreation Dept. will plan a recovery planting strategy and identify resources to replace ash in important public spaces with mixed species not threatened with invasive pests or pathogens.

3) Of the approximately 1841 total ash trees in Hartford's ROW, 80 are in poor condition, jeopardizing roads. 116 trees are in poor condition and jeopardize both roads and utility lines. Since these trees will become hazards first, it is recommended to remove them as soon as resources allow by either the Town or the Utility companies respectively.

4) In time, perhaps a period of 10 years, approximately 779 trees will jeopardize utility lines as the EAB establishes itself. The town should notify utility officials of this eventuality.

5) In that same 10 year timeframe, approximately 803 trees, jeopardizing the roads, will need to be removed.

6) A site within the local quarantine area should be established in advance and resources for transport, chipping and disposal of wood should be anticipated.

7) Felled trees or wood must remain within the local quarantine area however, wood or chips may be utilized within the preparedness plan guidelines. Unless chipped, felled trees left in place on back road ROW will preferably be cut or grooved longitudinally to hasten drying and reduce EAB habitat. The worst outcome in terms of hazard and EAB spread is leaving infested trees standing.

Town of Hartford VT Emerald Ash Borer Preparedness Plan

& Response recommendations for the EAB threat to ash trees.

January 2014
James B. Goedkoop, Hartford Tree Warden

Description: Since discovered about 10 years ago, the invasive pest Emerald Ash Borer (EAB) has spread across the Eastern US from Michigan and is now present in states bordering Vermont. This insect will inevitably destroy most, if not all, ash trees not protected by routine insecticide treatments. As an agent of lasting environmental change in the northeast, the EAB is on par with Dutch elm disease and chestnut blight of the last century. This plan describes the scope of the threat to public property and recommended actions before the EAB is detected, after it is detected, and when it is established.

Team Members

Name	**Responsibility**	**Contact**
James B. Goedkoop Hartford Tree Warden	Team Leader	Phone: 802 – 2959908 Email: hartfordtreewarden@gmail.com
Xaxakwetet Little Tree	First Detector	Phone: 603-252-8046 Email: danceatctm@comcast.net
Jim Esden	Forester II	Phone: 802-885-8822 Email: jim.esden@state.vt.us
Linda Louzier	Inventory volunteer	Phone: Email: louzierl53@comcast.net

A. PURPOSE:

By implementing the provisions in this preparedness and response plan, the town of Hartford is attempting to:

1. Mitigate the spread of the Emerald Ash Borer.
2. Distribute costs over a manageable time period.
3. Reduce hazards.
4. Manage our urban forest and street trees for improved health, resiliency, lower maintenance, beauty and environmental balance.

The plan applies to:
Public trees in the five villages of Hartford, West Hartford, Quechee, Wilder and White River Jct. as follows:

- Trees in parks/other town-owned recreational or natural areas.
- Trees on municipal property.
- Trees in the right-of-way (ROW) back roads.
- Trees on private land that impact town properties or the town ROW.
- Private trees as per relevant statues for quarantine per State or Federal regulation or the outreach of render services.

Responsibility:
Upon review and approval, this plan places responsibility for initiation on town management. Successful implementation over the anticipated 10 -15 year time frame will require the combined efforts of multiple entities including Parks & Recreation, Public Works, The Tree Board, Tree Warden, EAB First Detectors, Utility companies, outside contractors and others. The plan is intended to adapt to evolving circumstances and embrace other entities, resources, technologies and tools as they become available.

B. COMMUNITY TREE RESOURCE

A tree inventory was conducted in 2013 that included the Town of Hartford's five villages public property and right of way (ROW) ash trees as follows:

There are 63 ash trees distributed among the 5 villages with a concentration in Veteran's Park and several important trees in Ratcliff Park. Roadside tree inventory indicates at least 1778 trees with pockets of naturally propagated forest ash at intermittent locations on back roads. While the inventory was conducted as a complete tally, it must be assumed that the inventory reflects a minimum figure. Estimates from the Vermont Dept. of Forests, Parks and Recreation and the Windsor County Forester estimate a total ash count on both private and public property in Hartford at 260,000 trees.

Ash Tree Inventory

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(all reported in good condition, 63 trees)				
tree size DBH (diameter in inches at breast height)	1-6"	6-12"	12-18"	18+"
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** tree presenting both a hazard to road and utility lines				
(there were virtually no trees presenting a hazard to utility lines alone)				

Ash Distribution

C. PRIORITY TREES

Management of priority publicly owned trees. Since dead trees soon become structurally unstable, the process for hazard reduction requires a prioritization of tree removal.

High Priority -- Street trees in densely settled/high use areas, Village centers and along emergency routes.

High Priority – Prominent shade or ornamental trees in parks and other town owned recreational areas.

Medium Priority - Trees on private land that impact town properties or the town ROW.

Medium Priority - Trees in the right of way on back roads likely to become hazards as the EAB threat progresses.

Low Priority - Trees in town-owned wooded area/natural areas.

Low Priority - Other privately owned trees.

Ash trees in the following areas have been classified as high value or important because of their size or location:

1. Veteran's Memorial Park
2. George Ratcliffe Park
3. Village Centers (specific trees to be determined by the Tree Board, Parks & Recreation Dept. and the Tree Warden.

D. MONITORING OF FOREST PESTS

Pest detection efforts

Early detection is critical to slowing pest spread and limiting its impact. Hartford is currently monitoring for EAB and is in the process of education and dissemination of informational material both to the public and to budget authority departments within the town. Timing of certain management actions is optimal when the pests are within 5-10 miles. An early warning will enable a more effective response.

Recommended actions:

Any municipal staff member or resident who observes or suspects an invasive pest, should first be directed to a Hartford designated first detector or staff at Vermont Invasives - http://www.vtinvasives.org/tree-pests/report-it. This website includes pest identification information and contact information for state and federal staff.

If a forest pest infestation is suspected, it must remain confidential until it is verified and the information has been made public by the appropriate authority. Animal, Plant, Health Inspection Service (APHIS) is the lead organization on the identification, eradication, management and quarantines for emerald ash borer (EAB). If EAB is found in Vermont, a federal quarantine will be established.

It is important that residents protect sensitive information about the presence of EAB until the proper authorities have released the information to the public. Privileged information also includes the pest name, location, and name and contact information for any landowner or individual requesting assistance with pest identification.

E. PLAN FOR TREE PROTECTION AND REMOVAL

1. **It is both possible and recommended to preserve certain high-value municipal trees using pesticides. Town staff or contractors applying pesticides will need to be certified by the State of Vermont. Specialized equipment is often required.**

Trees of high value to be protected by pesticides will be determined by the Tree Warden, Tree Board & Parks & Recreation Dept.

Insecticide applications will be conducted by ISA certified arborists licensed for pesticide application in the state of Vermont. The Town will review local permits, as necessary.

Independent contractors will be vetted through the Town procurement process of "Request for Proposals "RFP" requiring all necessary State/Federal certification.

Environmental impact and public safety notification will be distributed through social media (electronics) and news media via suitable press releases and communications from the public information officer, tree board and educational/environmental entities of the Town.

Costs needed to preserve high value trees:
Of the 63 Village ash trees, those of high cultural or public value will be identified by the Tree Warden, Tree Board and Parks & Recreation Dept. to plan for preventative measures. Protection can be accomplished with botanical insecticides. TreeAzin ® for example is a a systemic insecticide produced from Neem tree seeds, is registered by the US EPA and listed by the Organic Materials Review Institute for use in organic crops and is effective against EAB. While TreeAzin ® is not yet registered for use in Vermont, it is anticipated that other choices and similar or alternate pesticides will become available

2. **Policy for residents who wish to save right-of-way trees through pesticide treatment.**

Homeowners wishing to save right-of-way trees through pesticide treatment must have written permission from the Tree Warden, be informed of the ongoing responsibilities necessary to maintain protection over time and must use approved commercial contractors with current ISA and Vermont pesticide certifications.

3. **Removal of dead and dying trees through a prioritized process.**

The EAB will kill ash trees within a few years. After being killed, trees deteriorate quickly. If left in place, they may become hazardous, and allow more rapid spread of the pests they harbor. Priority areas for removing trees are identified in section A, Priority Trees. The Tree Warden is the only person authorized to approve removal of municipal trees.

Currently, the town assesses and prioritizes tree interventions based on their condition and hazard level. The decisions for intervention are made within budget considerations and under the supervision of the Tree Warden.

Similarly, EAB infected trees will be removed based on logistic factors by town employees, utility company contractors and private contractors.

Municipal employees will follow the town procedures for the work, training and equipment.

In the event that outside contractors are utilized, the town of Hartford will specify applicable tree removal and care standards.

High Risk Trees

Currently, approximately 196 ash trees exist, largely on back roads, that are in poor condition. Of these, 116 are a hazard to power lines. By power company regulations, hazard trees in the vicinity (10' radius) of power lines can only be removed by power company arborists. The town therefore, has responsibility for the remaining 80 high risk trees.

4. **Private property trees.**

The decisions to treat, remove, or retain private trees rests with the property owner, unless a private tree poses a threat to public safety or public property. The town is liable for hazardous trees that threaten public property or a public right-of way, which can also include private trees. The Vermont Tree Warden Statutes only give a town tree warden authority over shade trees on public property. If nuisance or hazard trees need to be removed from private property, property owners will be notified by the tree warden and have the option to remedy existing hazards or nuisance conditions prior to intervention of the town. The Town of Hartford follows the guidelines of the Comprehensive Tree Policy adopted on September 9, 2003. While the policy does not specifically reference pest infestations, it does address the authority and administration (Article V) related to the duties and responsibilities of the town for the care, preservation, pruning, planting, re-planting, removal or disposition of trees, shrubs, plants and other landscaping in parks, along streets and in other public areas.

F. DISPOSAL AND UTILIZATION OF WOOD

Quarantine area:

A federal quarantine will be established in the state or each portion of the state in which EAB has been found. Upon an authenticated discovery of EAB, the following will become regulated:

§301.53-2 Regulated articles.
The emerald ash borer; firewood of all hardwood (non-coniferous) species; nursery stock, green lumber, and other material living, dead, cut, or fallen, including logs, stumps, roots, branches, composted and un-composted chips of the genus *Fraxinus.*

Hartford will need to identify a location, within the quarantine boundaries, to collect, store, sort and process diseased or felled ash trees. Machines will be necessary to pick up, move, chip/grind, and cut woody material. The size of the designated quarantine area and the equipment needed depends upon the comprehensiveness of the response and practical considerations specific to Hartford.

A logical staging area for disposal and processing of infected wood is the organic waste and compost section and of the landfill however, the landfill's capacity is limited and probably will not accommodate utilization efforts. The level of utilization of ash trees, chips, logs etc. could be minimal, all inclusive or anything in between so Hartford may wish to designate potential sites of a varying acreage, in accordance with the response, and depending on anticipated volumes, availability of machines, personnel and resources. Currently, estimates of these land area requirements are being studied based on various scenarios of utilization. Cooperation and outreach with adjacent towns is advised since it is unlikely that the quarantine will isolate Hartford from neighboring towns. For disposal or re-location of felled wood within the quarantined area, collaboration with adjacent towns on wood disposal areas, chipping equipment, tree care crews, and utilization of ash materials (e.g., chip marketing) will also save staff time and resources

F. DISPOSAL AND UTILIZATION OF WOOD (CONTINUED)

A key aspect of reducing the spread of the EAB is properly disposing of or utilizing the wood, brush and stump grindings generated by the removal of infested trees. Since the majority of ash trees in Hartford's public property are roadside ROW forest trees, outside of the villages, the bulk of management and utilization efforts will be focused in these areas. At a very minimum, infested trees felled and left in place should be ripped (or grooved longitudinally) to hasten drying and reduce habitat for the EAB. It would however, be most productive, both from an environmental, ethical and economic standpoint, to utilize the wood and wood by-products of the felled trees.

Assuming there are more than 700 ash trees in both Town and utility line ROW with dbh (diameter at breast height) greater than 12" and potentially useful as lumber, it would be preferable to create mechanisms in cooperation with utility company arborists to make this wood available to wood users, portable sawmill owners, artisans, etc. rather than waste the wood. Green Mountain Power's forestry team has worked extensively on the EAB problem and is included as a resource contact in the community resource list below.

Town staff and contractors should be educated on maximizing value. Since arborists often don't prioritize the production of sawlogs or value-added wood products other than, perhaps, firewood, chips, sawdust and bark can be used in composting or the creation of mulch. For example, ash chips could be useful to offset the chronic shortage of dry chips as a bulking agent for compost. Landowners should be educated on the options to process their felled or diseased trees for maximum value. (There are publications currently in development from the VT Dept. of Forest, Parks and Recreation Depts. regarding this topic and more recommendations will be forthcoming)

Hartford should consider developing a firewood distribution site, especially for low income residents.

Owing to their location, some town trees, not preserved with pesticide treatments cannot be left in place or simply dropped in right of way (ROW). Regardless of whether a value-added program is adopted by the selectboard and town management, a quarantine disposal area of sufficient size complying with State and Federal requirements will need to be designated.

G. RECOVERY EFFORT PLAN

Of the Village ash trees, those of high cultural and public value will be identified by the Tree Warden, Tree Board and Parks & Recreations Dept. to plan for preventative measures. Protection will be accomplished with botanical insecticides or other approved treatments registered and currently available for use in Vermont. Treatments will commence when the EAB threat is within 10 – 25 miles of Hartford's borders or, when current best-accepted practice indicates.

Municipal employees doing maintenance will follow the town procedures for the work, training and equipment.

Independent contractors engaged in maintenance or mitigation efforts will be vetted through the Town procurement process of Request for Proposals (RFP) requiring all necessary State/Federal certification.

Planting:

Planting vacant spaces now before EAB or other forest pests are identified is recommended. Properly selected new trees will help create a diversified age profile and increase the health and vibrancy of the urban forest. Currently, the Hartford Tree Board, Dept. of Parks and Recreation, and the Tree Warden are active in identifying existing vacant planting spaces and planting strategies. The EAB threat however, illustrates the need for diversification of species as a management tool for protection from future threats. While most everyone is familiar with the devastation caused by the Dutch elm disease to our urban landscapes, much the same catastrophe is again unfolding in cities that are overusing ash. In some cities, the problem, while known to everyone, simply repeated itself.

Hartford's Overrepresented species:

The rule of thumb on diversity is no more than 10% of a tree population in one species and no more than 20% in one genus. The 2013 tree inventory of public trees in Hartford's five villages shows the following:

Species:
EASTERN WHITE PINE 246 trees (18%)
NORTHERN RED OAK 209 trees (16%)
NORWAY MAPLE 123 trees (9%)
ORNAMENTAL 76 trees (6%)

Genera:
Acer (23%)
Pinus (18%)
Quercus (17%)
Ornamental (6%)
Fraxinus (5%)

The data shows that Hartford is over represented in Eastern white pine, Northern red oak and the *genera Acer (maple group)*

While Norway maple is considered an invasive species and is no longer being planted in Hartford's public spaces, the data demonstrates the need for vigilance in focusing on diversity. The 2013 inventory only includes street trees and those in prominent public places but not other parts of Hartford. If the thousands of Boxelder *(acer negundo)* were included, it is clear that we are over-represented in *acer.*

Hartford will minimize the planting of overrepresented species based on current management information and species density recommendations for Vermont communities.
Currently, tree planting strategy is focused on planting native species with the exception of those with known susceptibility to pathogens or invasive insect threats.

The Tree Board, Tree Warden and the Parks and Recreation Dept. have historically taken the role of new plantings in public places and will continue to do so. The Hartford Planning Commission, Conservation Commission and Tree Board reviews and inspects landscape design plans in redevelopment and development projects and either suggests or requires the plantings in public spaces.

H. AUTHORITY:

The Town of Hartford's Comprehensive Tree Policy, adopted on September 9, 2003, may be sufficient to respond to invasive pest threats; however, it is recommended that the town reviews its authority to enter private property for inspection of diseased or hazardous trees, the authority to order the removal or treatment of diseased/infected tree(s), and the authority to remove or treat diseased/infected tree(s) upon non-compliance of a property owner.

Costs

Resources will be needed (funds, materials and labor) for an EAB response action for public trees and private trees affecting the right-of-way or public land. Various response options are available and choices will need to be made on whether to treat or remove trees, whether to spread the costs over time or deal with them all at once and what kind of training, equipment, supplies and contracts Hartford will need.

The estimated costs of tree removals and wood disposal and utilization of wood byproducts for EAB infected ash on ROW back road and thoroughfares will be based upon the findings of the 2013 inventory data and Tree Warden's report and projected by town authorities in conjunction with utility company personnel and qualified private contractors. For preliminary cost projections, see appendices 1 and 2.

For public ash trees on municipal property, parks, schools and village centers; the costs of removals, stump grinding, insecticide treatments, preservation of important public trees, pruning, maintenance and re-planting will be projected by the Dept. of Parks & Recreation, the Tree Board and the Tree Warden.

I. COMMUNITY RESOURCE LIST.

Representing Role/Responsibility	Name	Contact
Mayor/Town Manager/ Selectboard Chair	Hunter F. Rieseberg	Phone:802 2959353 Email:
Public Information Officer – Park and Rec Director	Tad Nunez	Phone: 802 2955036 Email:
First Detector	Xaxakwetet Little Tree	Phone: 603-252-8046 Email: danceatctm@comcast.net
Tree Warden	James B. Goedkoop (Brad)	Phone: 802 2959908 Email: hartfordtreewarden@gmail.com
Tree Board Member(s)	See attached list	Phone: Email:
Vermont Dept of Forests, Parks & Recreation	Jim Esden	Phone: 802-885-8822 Email: jim.esden@state.vt.us
Community Forestry Outreach Coordinator UVM ext.	Caitlin Cusack	Phone: 802 656 7746 Email: caitlin.cusack@uvm.edu
Conservation Commission	See attached list	Phone: Email:
Planning Commission Member - Chair	Bruce Riddle	Phone: 802 2953075 Email:
Director of Parks/Recreation Committee Member	Tad Nunez	Phone: 802 295 5036 Email: tnunez@hartford-vt.org
Local Emergency Management Coordinator	Steve Locke	Phone: Email:
Director of Public Works	Rich Menge	Phone: Email: rmenge@hartford-vt.org
Certified pesticide applicators in category 3A	Matt Wood	Phone: (802) 828-3482 Email: Matthew.Wood@state.vt.us
Certified arborists/tree removal contractors. Go to http://www.isa-arbor.com/faca/findArborist.aspx		Phone: Email:
Hartford Garden Friends Club		Phone: Email:
Vermont Coverts Cooperators	Lisa Sausville	Phone: (802) 388-3880 Email: lisa@vtcoverts.org
Conservation Commission		Phone: Email:
Master Gardeners	Lisa Chouinard	Phone: (802) 656-9562 Email: master.gardener@uvm.edu
SOUL Tree Stewards	Kate Forrer	Phone: (802) 223-2389 Email: Katherine.Forrer@uvm.edu
Green Mountain Power forestry team	Duane Dickinson	Phone: Email: Duane.Dickinson@greenmountainpower.com

Communication

The Hartford community will relay decisions and updates to residents, elected officials and local businesses to keep the community informed with up-to-date information, fostering support for pest management activities, budgeting, making sure infested material is property disposed of and ultimately, work towards the prevention of the spread of pests.

The method of communication will include:

- Town website
- Tree Board website
- Periodic updates and public outreach information in the Valley News
- Public Meeting including the Tree Board, Conservation Commission and Selectboard meetings
- Tree Warden's Annual Report included in the Town Annual Report
- Displays and information booth at town events including the tree board's annual arbor day tree sale
- The conservation commission newsletter

J. ADDITIONAL RECOMMENDATIONS

Mitigation

State foresters estimate the total number of ash trees on public and private land in Hartford at 260,000 trees; however, the estimated number of trees on public property and right of way, done by an actual count in 2013, amounts to about 2000 trees. Many of these 2000 trees will become a hazard to roads, utility lines and public property. The costs to manage and replace over a 10 – 15 year period is to be determined as various response levels are available.

It would be useful to separate the mitigation role into 2 categories.

Category 1:
The Dept. of Parks & Recreation, the Tree Board and Tree Warden will address village trees, park trees, municipal trees, school trees and important shade trees.

Category 2:
The Dept. of Public Works, the Utility Companies and associated subcontracted arborists will address back road right of way hazard issues and utility conflicts.

Estimated costs to plant vacant sites over 5 years with diversified tree species and providing necessary after care to ensure establishment will be estimated by Hartford's Dept. of Parks and Recreation, the Tree Board and the Tree Warden.

Current Town Resources

The Town of Hartford has an updated street tree inventory with information on tree attributes and condition. Additionally, as a template, this preparedness plan allows for effective forest pest management and will allow staff to systematically focus on public high-priority areas.

The town has a Tree Warden, road crew reporting to the Director of Public Works, a Forest Pest First Detector and a Director of Parks and Recreation to help with education and outreach. The crew size is not adequate to handle EAB-related tree work, even if distributed over a multi-year plan. It is anticipated that there is sufficient administrative support to respond to forest pest public inquiries, hazard inspections, training, scheduling, contracting, and media relations that are inherent with forest pest management.

Proactive responses tailored to resources

- Establish a budget for forest pest related activities. Although timelines are uncertain, funding used to implement this plan will greatly increase the town's capacity to respond to current demands and to address future threats to the community forest.
- Continue engaging citizens, business owners and decision makers to educate and inform them of the emerald ash borer. Utilize the town website, newsletter, mailings, and public meetings to help with early detection and help garner public support.
- Implement short and long-term management plans to reduce the town ash population by removing trees that are identified as being in poor health due to non-forest pest related factors.
- Increase town capacity to move and store pest-infested generated wood waste by determining the quarantine site; purchasing, leasing or renting equipment such as large chippers, log loaders, or grinders; or modifying existing equipment.
- Cultivate beneficial partnerships with neighboring towns. Similar municipalities have used partnerships to effectively find cost-effective solutions to equipment needs and wood utilization programs.

Our understanding of forest pest management is constantly expanding as managers gain experience dealing with these invasive pests and as new research is conducted. Accordingly, this plan will be updated on an as-needed basis. Many of the actions accomplished from this plan will have positive, long-term benefits for the community. Our citizens will have a greater understanding and appreciation for our forest and urban tree resources, our community will be much better prepared for future invasive pests, and we will have established relationships with people and organizations that will be invaluable to us in maintaining the many environmental, economic and societal benefits of a healthy urban forest.

As team leader, any omissions or errors are wholly my responsibility. However, this research would not have been possible with the tireless work of the following dedicated volunteers:

Clare Forseth, Tree Inventory Volunteer
Sharon Goedkoop, Tree Inventory Volunteer
Linda Louzier, Tree Inventory Volunteer
Amalia Torres, Hartford Tree Board Member
Xaxakwetet Little Tree, Hartford's Forest Pest First Detector & Tree Inventory Volunteer

And the tremendous technical support of:

Caitlin Cusack, Community Forestry Outreach Coordinator, UVM Extension
Jim Esden, Forester II, Vermont Dept. of Forests, Parks & Recreation
Danielle Fitzko, Urban and Community Forestry Ourtreach Specialist
Kate Forrer, UVM Extension, Urban and Community Forestry Outreach Specialist
Cliff Sadof, Purdue University, Dept. of Entomology
Trish Hansen, Entomologist, Essex Jct. District Office, Forest Biology Lab, VT Dept. of Forests, Parks & Recreation

Assessment of Emerald Ash Borer Management Options for **hartford villages**

by
james goedkoop*

*This report was prepared using the Emerald Ash Borer Cost Calculator developed at Purdue University,

Tree Size Class Distribution

Size Span (inches)	Number of Trees
1 - 3	0
3 - 6	26
6 - 12	22
12 - 18	6
18 - 24	9
24 -	0

Treatment and Removal Costs

Treatment Cost:

DBH	Cost / DBH
1 - 3	$8.50
3 - 6	$8.50
6 - 12	$8.50
12 - 18	$8.50
18 - 24	$8.50
24 -	$8.50

Treat Every: 1 year(s)

Replacement Cost: $400.00 /tree

Removal Cost:

DBH	Cost / DBH
1 - 3	$11.15
3 - 6	$11.15
6 - 12	$13.35
12 - 18	$17.75
18 - 24	$17.75
24 -	$25.00

Years to Remove: 7

Discount Rate: 3%

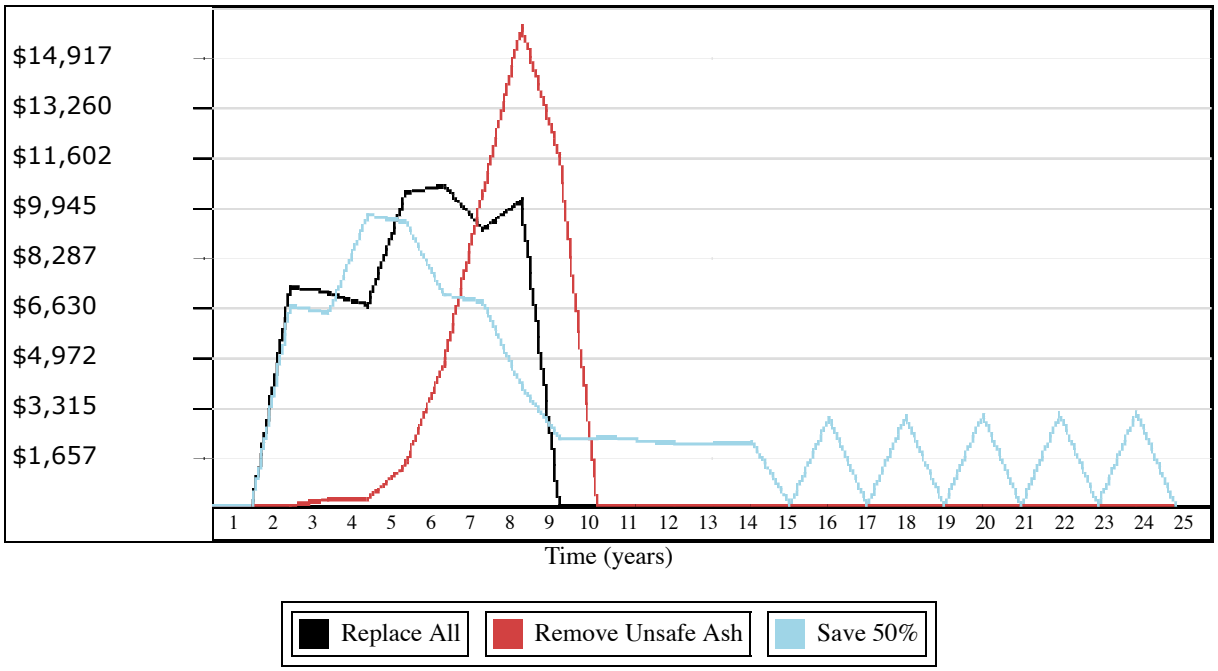
Ash Mortality Rate: 2%

Replacement Mortality Rate: 2%

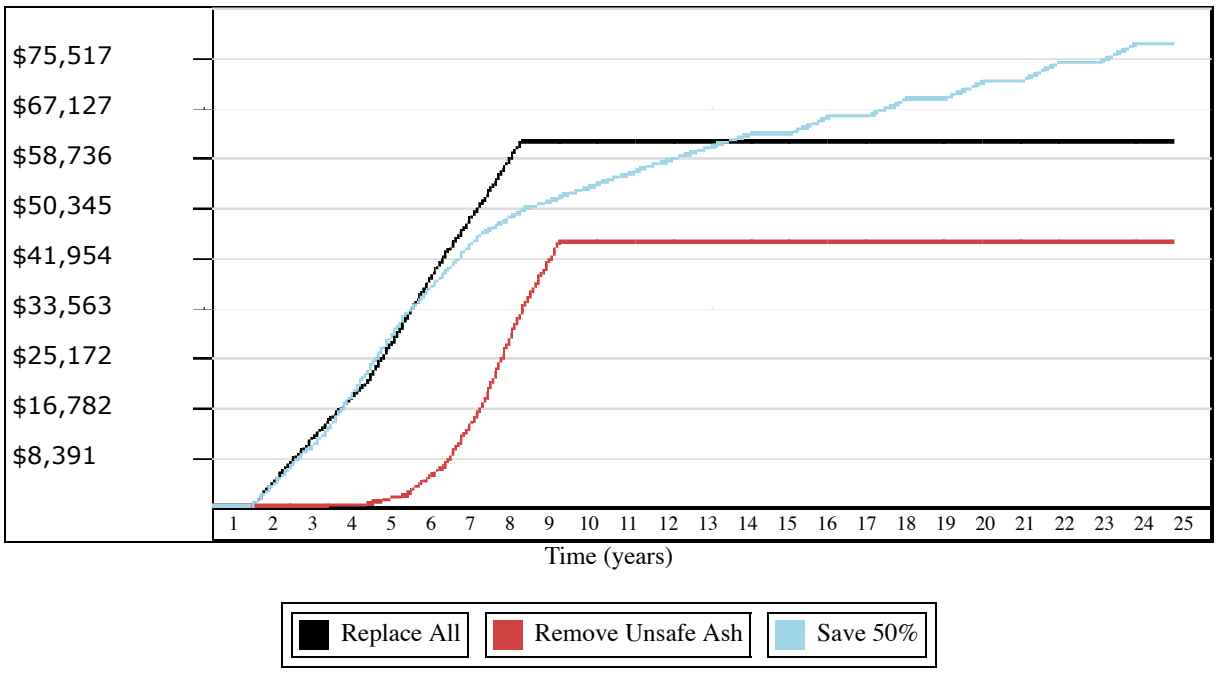
Management Plans

Plan	Description	Why Important
Replace All	All ash trees will be removed and replaced with a new tree.	This option replaces every ash tree with a new tree that won't get emerald ash borer. No pesticides are applied. In time the ash forest will be replaced with a different forest. Depending on local costs for pesticide treatment and removal, large trees can be less expensive to protect than to remove. Although based on out of pocket dollars this plan is the least costly way to manage your forest and allow it to regain its former size, it discards many healthy trees that provide real economic value to the city. Use the graph of forest size (Total DBH over Time) to determine how long it will take the forest to get back to its original size.
Remove Unsafe Ash	This plan will remove an ash tree after enough of it has been killed to make it likely to drop limbs or fall down. These would be ash trees that have lost more than half of their crown. Unless you specify otherwise, the calculator assumes that your forest starts out with only 1% of the ash trees damaged to this extent in year 1. The accumulated percent of trees damaged to this extent doubles every year. All ash trees will be replaced 8 years after 1% of trees reach this level of damage. No ash trees will be treated or replaced.	This plan helps you estimate the cost of removing trees that are likely to become unsafe as EAB moves through your forest. This plan puts off the bulk of the cost for tree removal until year 6, 7 and 8 after trees start dying when 68% of the trees will have to be removed. Be sure to compare the annual and accumulated costs with that of plans that even out annual costs over a longer time period.
Save 50%	In this strategy half of the trees will be treated and the other half will be replaced.	This strategy helps you to determine the relative advantage of saving your some of your trees. We chose 50% as the default so you could adjust up or down depending on your budget.

Annual Cost Comparison in Today's Dollars Over Time With a 3% Discount Rate

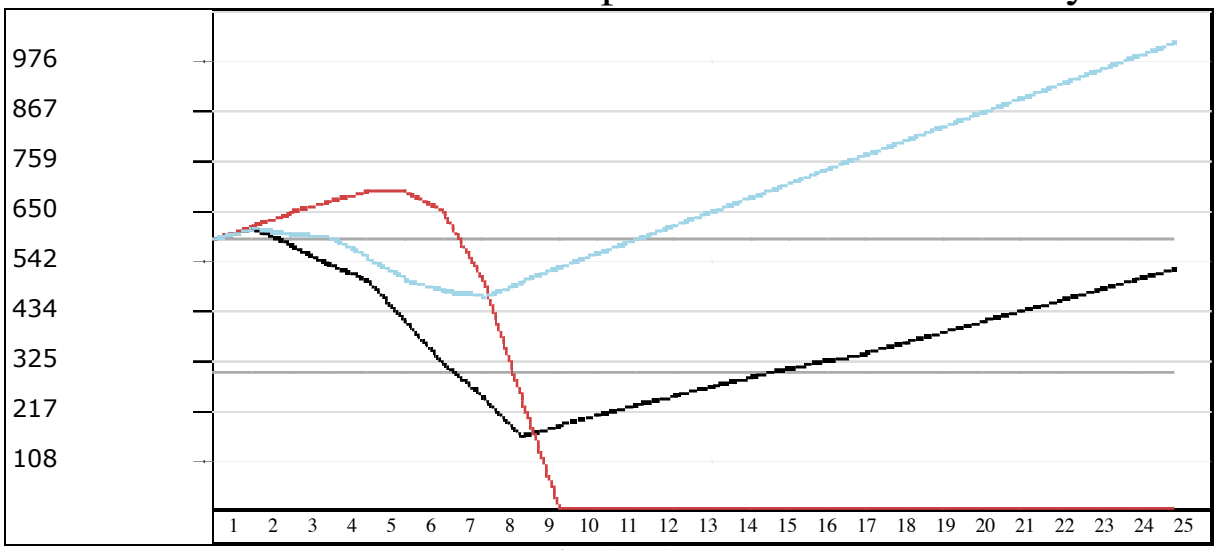


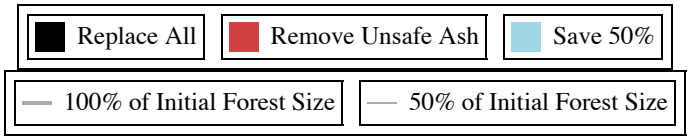
Cumulative Cost Comparison in Today's Dollars Over Time With a 3% Discount Rate



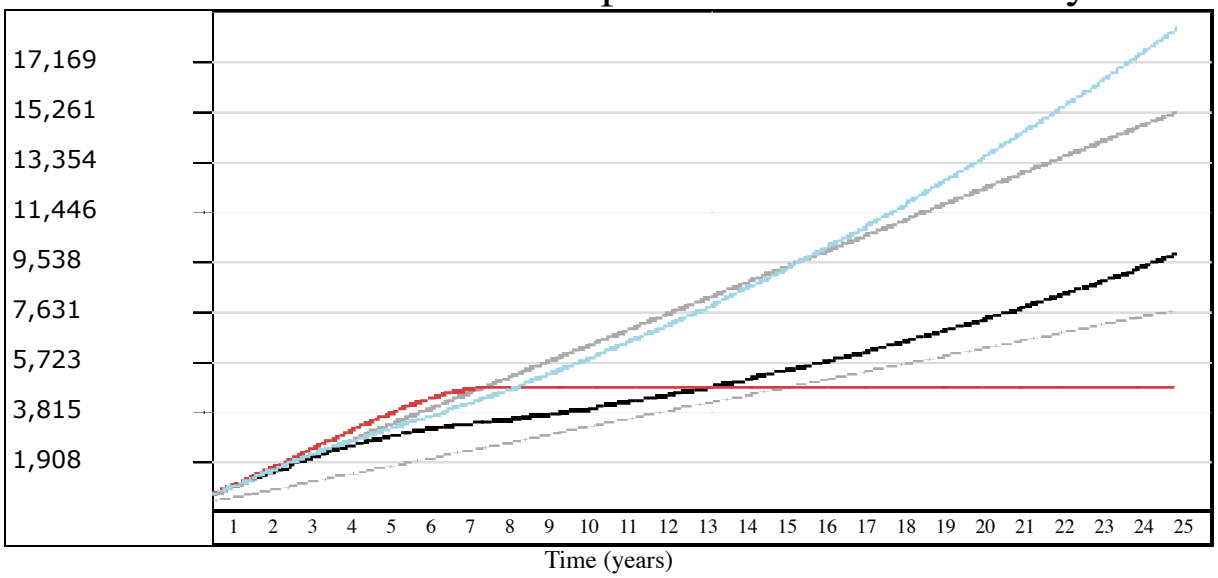
	Replace All		Remove Unsafe Ash		Save 50%	
Year	**Cost This Year**	**Total Cost**	**Cost This Year**	**Total Cost**	**Cost This Year**	**Total Cost**
1	$0	$0	$0	$0	$0	$0
2	$0	$0	$0	$0	$0	$0
3	$7,224	$7,224	$0	$0	$6,606	$6,606
4	$7,029	$14,253	$206	$206	$6,372	$12,978
5	$6,604	$20,857	$209	$415	$9,616	$22,594
6	$10,375	$31,232	$1,386	$1,801	$9,411	$32,005
7	$10,596	$41,828	$4,709	$6,510	$6,971	$38,976
8	$9,155	$50,983	$10,278	$16,789	$6,751	$45,727
9	$10,128	$61,112	$15,912	$32,700	$3,926	$49,653
10	$0	$61,112	$11,576	$44,276	$2,228	$51,881
11	$0	$61,112	$0	$44,276	$2,262	$54,143
12	$0	$61,112	$0	$44,276	$2,143	$56,286
13	$0	$61,112	$0	$44,276	$2,027	$58,313
14	$0	$61,112	$0	$44,276	$2,058	$60,370
15	$0	$61,112	$0	$44,276	$2,087	$62,457
16	$0	$61,112	$0	$44,276	$0	$62,457
17	$0	$61,112	$0	$44,276	$2,910	$65,367
18	$0	$61,112	$0	$44,276	$0	$65,367
19	$0	$61,112	$0	$44,276	$2,957	$68,324
20	$0	$61,112	$0	$44,276	$0	$68,324
21	$0	$61,112	$0	$44,276	$3,000	$71,324
22	$0	$61,112	$0	$44,276	$0	$71,324
23	$0	$61,112	$0	$44,276	$3,040	$74,363
24	$0	$61,112	$0	$44,276	$0	$74,363
25	$0	$61,112	$0	$44,276	$3,077	$77,440

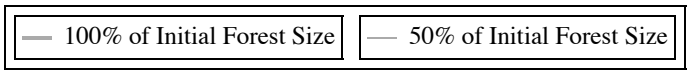
Total DBH Over Time
with 2% Ash and 2% Replacement Tree Mortality





Cumulative DBH-Years Over Time
with 2% Ash and 2% Replacement Tree Mortality




100% of Initial Forest Size
50% of Initial Forest Size

	Replace All		Remove Unsafe Ash		Save 50%	
Year	Total DBH This Year	Cumulative DBH-Years	Total DBH This Year	Cumulative DBH-Years	Total DBH This Year	Cumulative DBH-Years
0	583.50	583.50	583.50	583.50	583.50	583.50
1	607.44	607.44	612.16	612.16	607.44	607.44
2	569.04	1,176.48	640.83	1,252.99	593.38	1,200.82
3	529.73	1,706.22	664.32	1,917.32	588.42	1,789.24
4	493.90	2,200.11	687.14	2,604.45	540.96	2,330.20
5	404.62	2,604.73	687.77	3,292.22	493.61	2,823.81
6	313.43	2,918.16	640.12	3,932.34	470.49	3,294.30
7	240.87	3,159.03	499.47	4,431.81	457.58	3,751.87
8	155.65	3,314.68	240.85	4,672.66	492.04	4,243.91
9	179.43	3,494.10	0.00	4,672.66	522.52	4,766.43
10	202.29	3,696.39	0.00	4,672.66	553.01	5,319.44
11	224.24	3,920.64	0.00	4,672.66	583.49	5,902.93
12	245.75	4,166.38	0.00	4,672.66	613.98	6,516.91
13	265.43	4,431.81	0.00	4,672.66	644.46	7,161.37
14	285.11	4,716.91	0.00	4,672.66	674.95	7,836.31
15	302.97	5,019.88	0.00	4,672.66	705.43	8,541.75
16	320.83	5,340.70	0.00	4,672.66	735.92	9,277.66
17	336.87	5,677.57	0.00	4,672.66	766.40	10,044.06
18	359.61	6,037.18	0.00	4,672.66	796.89	10,840.95
19	382.37	6,419.55	0.00	4,672.66	827.37	11,668.32
20	405.11	6,824.66	0.00	4,672.66	857.86	12,526.18
21	427.87	7,252.53	0.00	4,672.66	888.34	13,414.52
22	450.61	7,703.14	0.00	4,672.66	918.83	14,333.35
23	473.37	8,176.51	0.00	4,672.66	949.31	15,282.66
24	496.11	8,672.62	0.00	4,672.66	979.80	16,262.45
25	518.87	9,191.49	0.00	4,672.66	1,010.28	17,272.73

Assessment of Emerald Ash Borer Management Options for **hartford back ROW**

by
james goedkoop*

*This report was prepared using the Emerald Ash Borer Cost Calculator developed at Purdue University,

Tree Size Class Distribution

Size Span (inches)	Number of Trees
1 - 3	0
3 - 6	181
6 - 12	365
12 - 18	257
18 - 24	80
24 -	0

Treatment and Removal Costs

Treatment Cost:

DBH	Cost / DBH
1 - 3	$8.50
3 - 6	$8.50
6 - 12	$8.50
12 - 18	$8.50
18 - 24	$8.50
24 -	$8.50

Treat Every: 1 year(s)

Replacement Cost: $400.00 /tree

Removal Cost:

DBH	Cost / DBH
1 - 3	$11.15
3 - 6	$11.15
6 - 12	$13.35
12 - 18	$17.75
18 - 24	$17.75
24 -	$25.00

Years to Remove: 7

Discount Rate: 3%

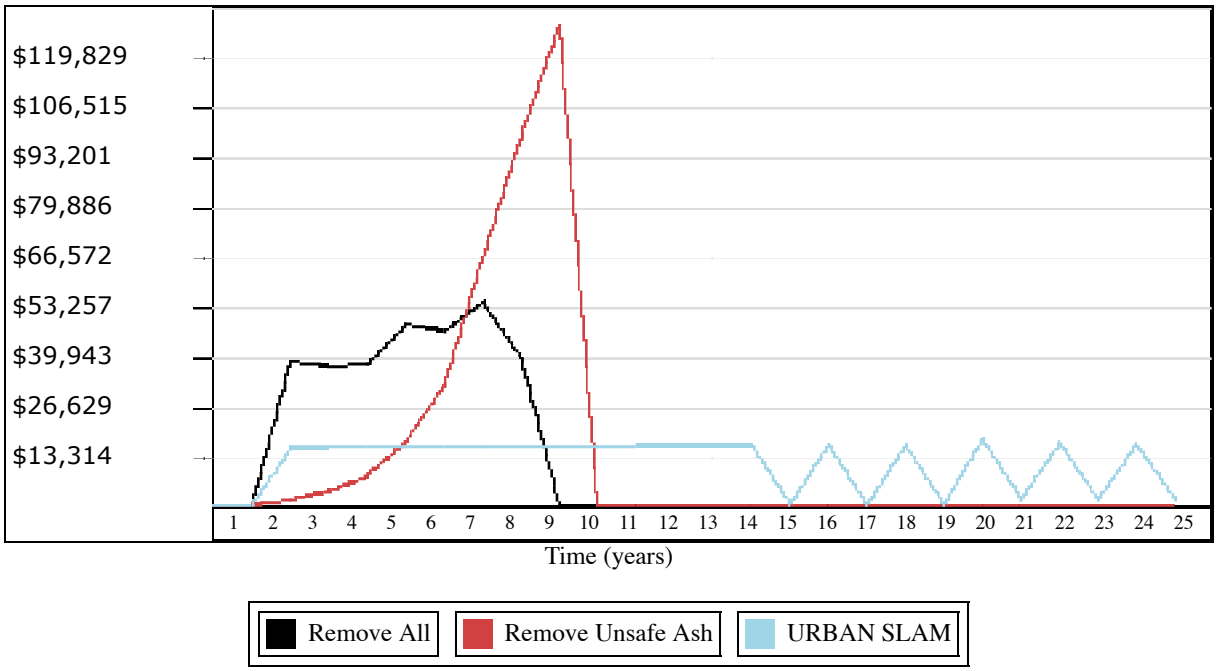
Ash Mortality Rate: 2%

Replacement Mortality Rate: 2%

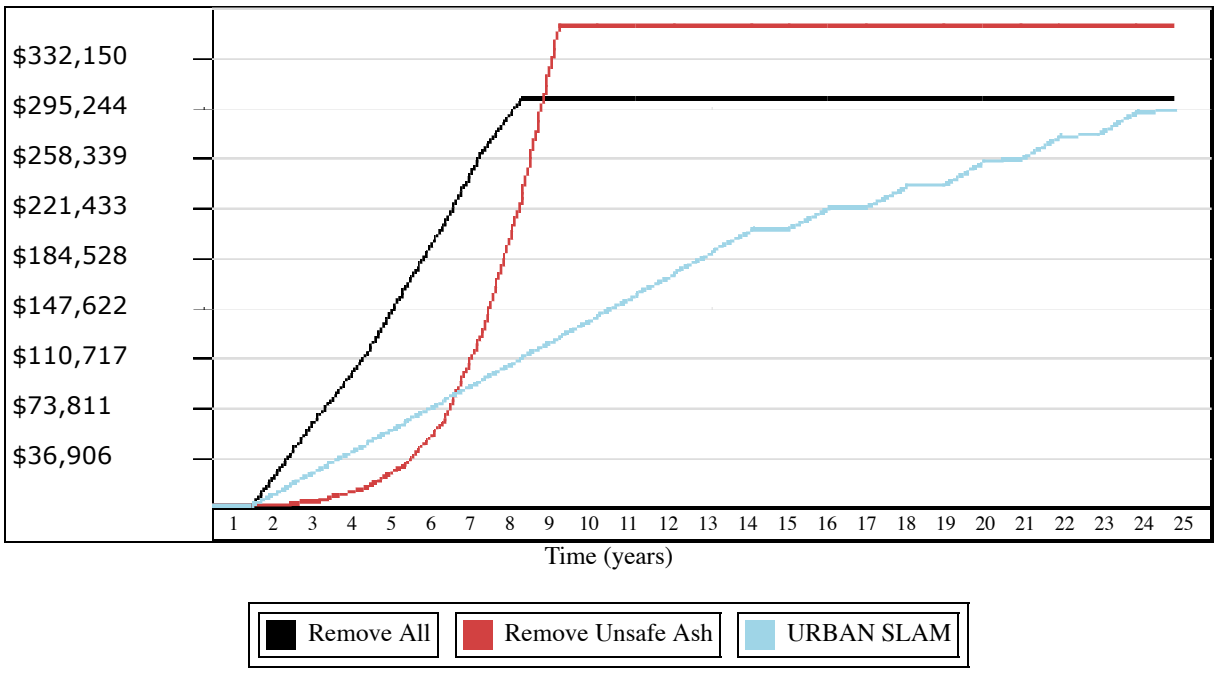
Management Plans

Plan	Description	Why Important
Remove All	All ash trees will be removed. No trees will be replanted.	After the EAB comes to your city you will have to remove the ash trees in order to prevent dead trees from falling on people or property and causing harm. Although this plan has the lowest long term out of pocket expenses it removes valuable healthy trees that may be saved with insecticides. Depending on local costs for pesticide treatment and removal, large trees can be less expensive to protect than to remove. In the long term from this plan causes the greatest losses to the aesthetic, ecological value that ash trees provide your city. Use the graph of forest size (Total DBH over Time) to determine how long it will take the forest to get back to its original size in comparison to plans that replace the ash trees which have been removed.
Remove Unsafe Ash	This plan will remove an ash tree after enough of it has been killed to make it likely to drop limbs or fall down. These would be ash trees that have lost more than half of their crown. Unless you specify otherwise, the calculator assumes that your forest starts out with only 1% of the ash trees damaged to this extent in year 1. The accumulated percent of trees damaged to this extent doubles every year. All ash trees will be replaced 8 years after 1% of trees reach this level of damage. No ash trees will be treated or replaced.	This plan helps you estimate the cost of removing trees that are likely to become unsafe as EAB moves through your forest. This plan puts off the bulk of the cost for tree removal until year 6, 7 and 8 after trees start dying when 68% of the trees will have to be removed. Be sure to compare the annual and accumulated costs with that of plans that even out annual costs over a longer time period.
URBAN SLAM	This plan treats protects 40% of the forest with TreeAge. This accomplished by applying the product to 20% of the trees each year. This strategy must be maintained until year 12 when the invasion wave has passed. Treatment should be deployed randomly and should not focus only on infested trees.	This strategy slows the mortality of ash trees when adults feeding on treated ash are killed. It has the potential to protect 100% of the ash trees in an area by only treating 40% of the trees. A complete tally of all ash trees on streets and in private property is needed to determine the number of trees that must be treated for this strategy to be successful. Using cost quotes for treating trees with TreeAge you can compare this strategy to Replace Unsafe Ash and Replace All to determine if an areawide program makes sense for you.

Annual Cost Comparison in Today's Dollars Over Time With a 3% Discount Rate

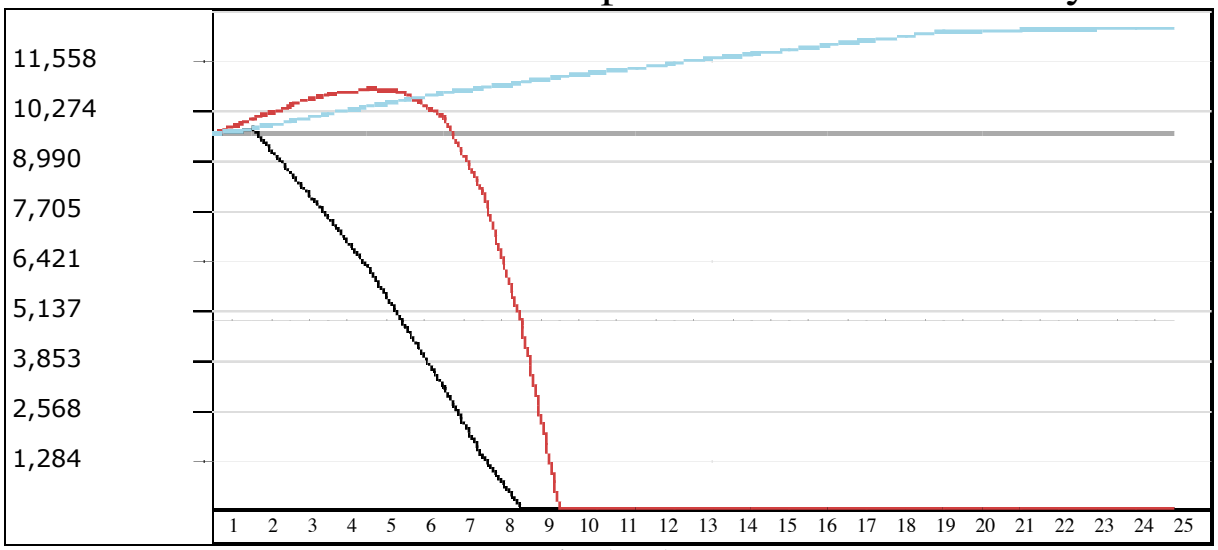


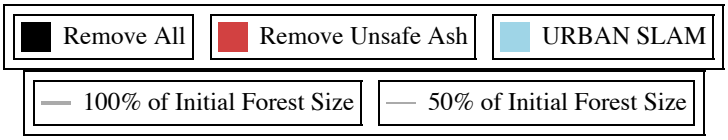
Cumulative Cost Comparison in Today's Dollars Over Time With a 3% Discount Rate



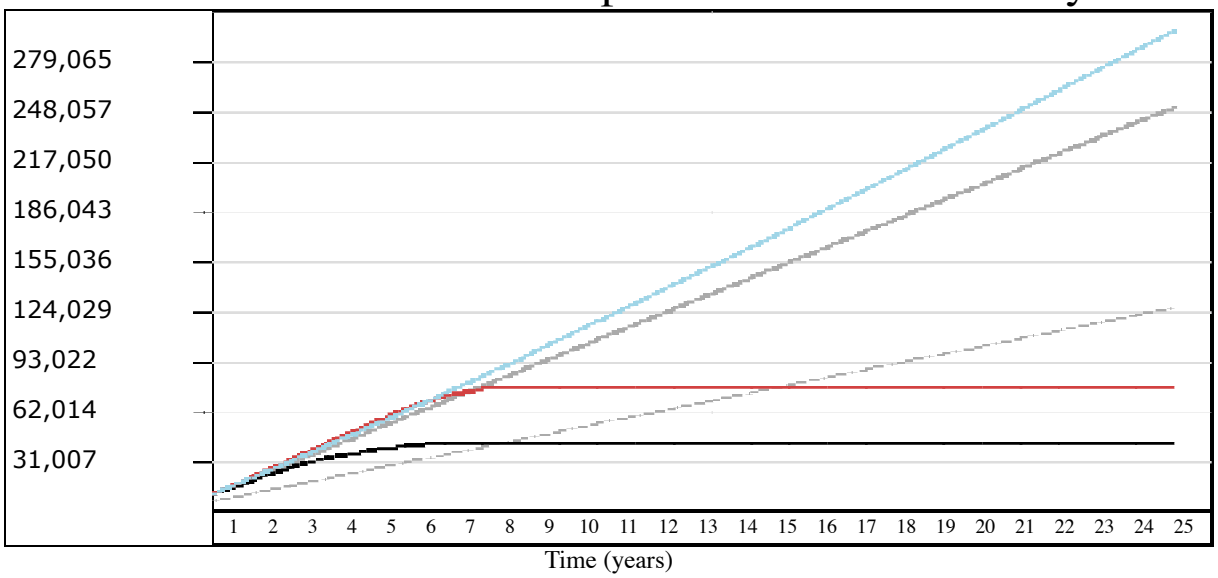
	Remove All		Remove Unsafe Ash		URBAN SLAM	
Year	**Cost This Year**	**Total Cost**	**Cost This Year**	**Total Cost**	**Cost This Year**	**Total Cost**
1	$0	$0	$0	$0	$0	$0
2	$0	$0	$326	$326	$0	$0
3	$38,255	$38,255	$1,457	$1,783	$15,427	$15,427
4	$36,965	$75,220	$3,901	$5,684	$15,502	$30,928
5	$37,598	$112,818	$8,139	$13,823	$15,564	$46,492
6	$48,131	$160,949	$16,831	$30,654	$15,619	$62,111
7	$46,355	$207,304	$31,781	$62,435	$15,662	$77,773
8	$53,953	$261,257	$65,637	$128,073	$15,589	$93,363
9	$39,182	$300,439	$98,403	$226,475	$15,650	$109,013
10	$0	$300,439	$127,818	$354,293	$15,724	$124,737
11	$0	$300,439	$0	$354,293	$15,767	$140,504
12	$0	$300,439	$0	$354,293	$15,827	$156,331
13	$0	$300,439	$0	$354,293	$15,861	$172,192
14	$0	$300,439	$0	$354,293	$15,909	$188,100
15	$0	$300,439	$0	$354,293	$15,945	$204,045
16	$0	$300,439	$0	$354,293	$192	$204,236
17	$0	$300,439	$0	$354,293	$15,977	$220,214
18	$0	$300,439	$0	$354,293	$206	$220,420
19	$0	$300,439	$0	$354,293	$16,005	$236,424
20	$0	$300,439	$0	$354,293	$198	$236,622
21	$0	$300,439	$0	$354,293	$17,444	$254,066
22	$0	$300,439	$0	$354,293	$1,573	$255,640
23	$0	$300,439	$0	$354,293	$16,854	$272,494
24	$0	$300,439	$0	$354,293	$1,558	$274,052
25	$0	$300,439	$0	$354,293	$16,297	$290,349

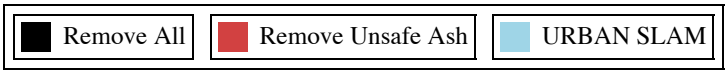
Total DBH Over Time
with 2% Ash and 2% Replacement Tree Mortality

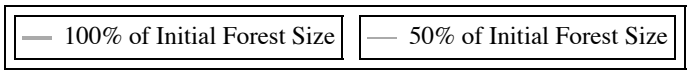




Cumulative DBH-Years Over Time
with 2% Ash and 2% Replacement Tree Mortality






100% of Initial Forest Size
50% of Initial Forest Size

	Remove All		Remove Unsafe Ash		URBAN SLAM	
Year	Total DBH This Year	Cumulative DBH-Years	Total DBH This Year	Cumulative DBH-Years	Total DBH This Year	Cumulative DBH-Years
0	9,624.00	9,624.00	9,624.00	9,624.00	9,624.00	9,624.00
1	9,776.96	9,776.96	10,012.03	10,012.03	9,776.96	9,776.96
2	8,619.72	18,396.68	10,364.07	20,376.11	9,960.93	19,737.89
3	7,464.87	25,861.55	10,641.79	31,017.89	10,139.64	29,877.53
4	6,224.13	32,085.68	10,786.73	41,804.62	10,328.94	40,206.47
5	4,660.09	36,745.77	10,655.86	52,460.48	10,511.19	50,717.66
6	3,104.27	39,850.04	10,028.91	62,489.40	10,683.65	61,401.31
7	1,329.40	41,179.45	8,165.77	70,655.16	10,816.99	72,218.30
8	0.00	41,179.45	4,761.92	75,417.08	10,952.62	83,170.93
9	0.00	41,179.45	0.00	75,417.08	11,080.66	94,251.58
10	0.00	41,179.45	0.00	75,417.08	11,200.79	105,452.37
11	0.00	41,179.45	0.00	75,417.08	11,311.85	116,764.23
12	0.00	41,179.45	0.00	75,417.08	11,440.38	128,204.60
13	0.00	41,179.45	0.00	75,417.08	11,563.03	139,767.63
14	0.00	41,179.45	0.00	75,417.08	11,673.56	151,441.19
15	0.00	41,179.45	0.00	75,417.08	11,780.96	163,222.16
16	0.00	41,179.45	0.00	75,417.08	11,903.57	175,125.73
17	0.00	41,179.45	0.00	75,417.08	12,020.05	187,145.78
18	0.00	41,179.45	0.00	75,417.08	12,132.51	199,278.29
19	0.00	41,179.45	0.00	75,417.08	12,236.46	211,514.75
20	0.00	41,179.45	0.00	75,417.08	12,258.51	223,773.27
21	0.00	41,179.45	0.00	75,417.08	12,286.67	236,059.94
22	0.00	41,179.45	0.00	75,417.08	12,308.98	248,368.91
23	0.00	41,179.45	0.00	75,417.08	12,322.07	260,690.98
24	0.00	41,179.45	0.00	75,417.08	12,328.62	273,019.60
25	0.00	41,179.45	0.00	75,417.08	12,327.89	285,347.49