

# **Middlebury Emerald Ash Borer Management Plan**

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Judy Wiger-Grohs, Sally Thodal  
Middlebury Tree Adhoc Committee

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## Introduction

Trees. They provide shade, enhance aesthetics, reduce stormwater run-off, clean the air, store carbon dioxide, conserve energy, provide a canopy and habitat for wildlife, and increase property values.

Emerald Ash Borer or EAB has been responsible for the premature death of tens of millions of ash trees in the United States (<http://northernwoodlands.org>). The potential costs to Vermont municipalities from EAB will be considerable. It has been announced that no state or federal monies will be made available for municipalities dealing with EAB and that the cost burden of EAB management will be on local governments. The current inventory of public ash trees shows that Middlebury and East Middlebury combine to have over 70 ash trees just in town right-of-ways, and all are at risk from EAB.

Although EAB has not yet been detected in Middlebury it was recently found in Bristol, VT. An eventual infestation here is inevitable. Ash trees can be found throughout our area, along community streets, in public parks, in Battell and Means Woods and along the “Trail Around Middlebury”. Infested trees rapidly decline and die within 3-5 years. The dead ash trees are prone to drop large limbs and pose a significant public safety and personal property hazard.

The purpose of this plan is to provide information and guidance *prior* to an EAB infestation and to continue providing information and guidance once EAB arrives and intensifies. This plan reinforces the urgency to take action and promote proactive planning and management for EAB. This plan does not include ash trees on rural roads and on town-owned land such as the Middlebury Recreation Park. The plan recommends management of the ash trees in Middlebury in order to achieve the following goals:

1. Reduce potential public health, safety and property hazards associated with EAB.
2. Mitigate the economic, social and environmental costs associated with control efforts and damage.
3. Prevent further unintended human-caused spread of EAB.
4. Align Middlebury’s maintenance plan with the most recent research on EAB management and control.

It is important for Middlebury to take a proactive approach and plan for the impact EAB will have on its community and municipality. Identifying the potential impacts and developing a plan and management strategy are the most effective ways to minimize the costs and mitigate the negative impacts of EAB.

## What is EAB?

EAB is an invasive insect that feeds on, and eventually causes the death of all species of ash (genus *Fraxinus*) trees. Originating from Asia, the small metallic wood-boring beetle (family *Buprestidae*) is named for the brilliant emerald/green color of the adult.

Since its introduction into North America in 2002, EAB has spread into 35 states (Alabama, Arkansas, Colorado, Connecticut, Delaware, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Missouri, Nebraska, New Hampshire, New Jersey, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Vermont, Virginia, West Virginia and Wisconsin), the District of Columbia and five Canadian provinces (Ontario, Quebec, New Brunswick, Manitoba and Nova Scotia).

EAB was first discovered in Vermont in Orange County in February, 2018. Currently it has been detected in all Vermont counties with the exception of Essex and Lamoille counties.

Left to its own devices, a single EAB can travel a half mile per year, with the potential to expand its range during the adult beetles' June to August flight period. **Human transport, however, has led to the spread of the EAB over much greater distances.** Shipments of infested nursery stock and firewood have been inadvertently responsible for the majority of new EAB introductions.

## Signs and Symptoms

EAB infestations are very difficult to detect in the early stages and at low densities. The upper crowns of the ash trees are infested first; making the entrance cracks and exit holes in the bark nearly impossible to see early on. The best indicator of EAB is evidence of woodpecker foraging, which can be visible from long distances. It is important to remember that once woodpecker damage is visible the infestation is usually well established. When the tree begins to decline rapidly signs may include bark splitting, canopy thinning, and epicormic sprouting (water sprouts), although these symptoms can also be caused by other problems, including the common disease ash yellows.

Unfortunately it has been typical that by the time symptoms of the EAB are recognized the infestation is usually well under way and often even a few years old. For example, in the city of Concord, NH, when the signs of the EAB were noticed it has been estimated that the infestation was already over four years old. Up until that point it was assumed that there was no EAB in New Hampshire at all.

Most of the distinguishing indicators are also the least visible. Because the upper parts of the tree are infested first, all of the early indicators are very difficult to see from the ground. When the larva feeds on the cambium (the nutrient transport tissue below the bark), it kills the bark on top. The next year, as the new bark is formed under the old, the old is pushed out, and where it is dead, it cracks.

## Detection

Currently four methods are being employed in Vermont to detect the presence of EAB.

1. Visual – seeing characteristic signs and symptoms.
2. Traps – catching insects in the classic purple prism trap or the new, green funnel trap.
3. Trap trees – girdling trees in order to attract EAB. The insects are sensitive to chemicals released by stressed trees.
4. Biomonitoring – using *Cerceris fumipennis* (native ground wasp)

## Impact of EAB on Middlebury

The arrival of EAB and the death of the town's ash trees will have a variety of adverse impacts on Middlebury. These impacts include:

- The public health hazard posed by the dead ash trees. Without treatment, EAB can potentially kill all the ash trees in an infested area in a relatively short time frame. The dead trees rapidly begin falling apart and, depending on where the trees are located, can pose a threat to Middlebury's residents and tourists.
- Trees that are dead or dying are more dangerous for arborists to work in, resulting in greater costs associated with removing dead trees.
- The upper branches of the ash trees will die and can fall first, meaning live trees can still pose significant threat.
- The simultaneous death of multiple trees also compounds the problem if no preemptive measures are taken to identify, remove, and/or treat ash trees.
- The presence of so many dead and dying trees will be aesthetically damaging to a town known for the beauty of its wooded hills.

Middlebury will also experience less direct effects of an EAB infestation. These more subtle effects include:

- Other species will be dramatically affected by the loss of the area's ash trees.
- Invasive, non-native plant species may take over areas once inhabited by ash as a result of increased lower canopy light.
- Native species such as maple and birch that are used to less light may be crowded out.
- Native animals that depend on ash trees for food and shelter including ground beetles, spiders, butterflies, moths, birds and mammals will be adversely affected.
- The local ecology and soil chemistry will change from the mass die-off of ash. An increased number of dead trees left on the ground will alter soil pH, water content, mineral composition and nutrient availability.

## **Current Efforts**

During the summer of 2014 the VT Urban and Community Forestry Program, (VT UFC), coordinated and funded an individual street tree inventory of all trees, including ash, within the public right-of-way and on public land in the downtown centers of Middlebury and East Middlebury. The inventory was completed for Middlebury proper during the summer of 2016. Data obtained on the trees included their location, DBH (diameter at breast height), condition, distance to the street, and presence of electrical wires. At this time two streets in East Middlebury still need to be inventoried.

Ultimately the purpose of locating trees on public property and within the town right of way is to enumerate the population of ash trees in Middlebury and to allow for estimates of the economic impacts of the impending infestation on the town as well as to inform the most appropriate management activities. At some point in the future the Middlebury Tree Committee may begin work on a rural roadside tree inventory with an especial interest paid to the number of ash trees present. As new data is collected the committee will also update information on costs of the various management options.

## **EAB Management Options**

Currently there are three management options for dealing EAB. These options are as follows –

- Remove ash trees (reactively or proactively)
- Remove ash trees and replace them with resistant, native shade trees
- Treat trees with insecticide

Ash tree removal can be implemented one of two ways. An ash tree can be removed after infestation. However, it has been the experience of all other infested towns that once one ash tree is infested virtually all other ash trees will be infested also. This would result in the need for all infested trees to be removed within a relatively short amount of time, increasing the financial burden on the community and reducing the aesthetics of the area.

A public ash tree can also be removed prior to EAB infestation. This strategy provides time for project planning, as well as an opportunity to plan for and distribute costs. It is important to note implementation of this strategy is cheaper and safer as healthy trees fall in a more predictable manner and are easier to remove.

Ash tree removal prior to infestation has several important disadvantages to consider. These disadvantages include:

- Removal of healthy ash trees will have an immediate impact to the tree canopy and aesthetics.

- Removal of healthy trees may require a public hearing and could result in public opposition.
- Removal of these trees significantly reduces genetic variation including possible resistance to EAB.
- Ash trees play an important ecological role in local food webs.

The third option, preventative treatment with insecticide, can provide significant and consistent protection against EAB. Treatment can be accomplished using a soil-applied systemic insecticide, a trunk-injected systemic insecticide, a noninvasive systemic basal trunk spray or a protective cover spray. As with ash tree removal there are certain disadvantages to using insecticides, ones that differ depending on the treatment applied. Both the soil-applied systemic insecticide and the trunk-injected systemic insecticide have yielded inconsistent results in both the field and controlled experiments. Results of the protective cover spray can vary with tree diameter and canopy size. “Drift” of the spray onto other non-target trees can also be problematic. Trunk injection requires holes to be drilled that may provide an avenue for other disease-causing organisms and cause wounds that do not heal. Some trunk-injected pesticides are toxic to other wildlife, including bees and birds, and have the potential for groundwater contamination. To date two trees, both located on the Middlebury Town Green have been treated by trunk injection. Treatment will need to be repeated.

It is worth mentioning that new research on EAB and strategies to deal with it are frequently becoming available at various places around the country. Recently researchers for the National Forest Service and Ohio State University identified what they refer to as “lingering ash”. ([EAB - recent research](#)) “Lingering ash” are ash trees that remain in an area following an infestation as a result of inherent resistance. This is important to note in order to understand that a preparedness management plan written now is subject to change.



## Proposed Middlebury EAB Management Plan

The Middlebury Tree Committee proposes the following actions in preparation for and management of EAB.

- Dead ash trees and those ash trees in poor/fair condition have been removed.
- Larger ash trees with a DBH > 24” should be considered for treatment with triage or TreeAzin. Prioritize treatment according to how difficult the tree would be to take down, its size and potential use.
- All other ash trees – those in good condition, should be removed and replaced with alternative **native** trees. See Appendix A for a suggested planting list.
- Wherever possible two native trees should replace each ash tree removed. Special attention should be given to increasing species diversity. Consideration should be given to the purchase of 1 1/2 - 2” bare root trees as replacements.
- Information on EAB should continue to be communicated to members of the community. The Town’s website should include a permanent link on the HOME page for EAB. In spite of the Covid-19 pandemic members of the Middlebury Ad hoc Tree Committee have worked to increase community awareness. They have done so by tagging ash trees in a variety of locations including town streets, businesses and along trails. They have put up posters that describe signs of EAB infestation at entry points to the TAM and Battell and Means Woods. They conducted an EAB “Walk and Talk” on the Town Green, sponsored a coloring page in the Addison Independent and set up an EAB informational display at the Middlebury Town Offices.
- A line item should be designated for EAB plan preparedness in the 2021 budget and each year thereafter until EAB is no longer deemed a threat.

Estimated costs associated with the above proposals are as follows:

### Scheduled Tree Removal\* – Trees in good condition, 0-24” DBH

DBH	Ave. DBH	Price/DBH	# of Trees	Cost
0 - 6”	3	\$14.00	25	\$1050.00
6 – 12”	9	\$14.75	26	\$3451.50
12 – 18”	15	\$18.00	7	\$1890.00
18 – 24”	21	\$21.75	12	\$5481.00
<b>Totals</b>			<b>70</b>	<b>\$11,872.50*</b>

\* Price will vary widely based on condition of tree, proximity to overhanging wires, need for traffic control, etc. (Does not include stump grinding.)

\* Removal of healthy trees is currently on hold, at least until EAB is confirmed in Middlebury. This will provide the town with additional time to make the most informed decision.

**Preventative Treatment – Trees over 24”DBH**

DBH	Average DBH	# of trees	cost
24 – 30”	27”	3	\$1620
30+”	33”	1	\$660
<b>Totals</b>		<b>4</b>	<b>\$2280*</b>

- treatment costs are either every year or every two years depending upon the insecticide used.
- two trees located on the Town Green have already been treated. We are still considering treatment of at least one large ash tree at the Middlebury Rec. Park, adjacent to Mary Hogan School.

**Replacement for 70 Trees\***

- replacing each ash tree removed with two native trees\*
- using an average replacement cost of \$600/tree
- planting new trees =  $(70)(2)(600) = \$84,000^{**}$

\* Wherever possible plant replacement trees **before** taking down the ash tree

\*\* Price will vary with time.

## **Community Education and Outreach**

Due to EAB in our area we recommend increasing community education and outreach.

Outreach and education strategies include:

- Community presentations detailing the nature and extent of the problem, the impact on Middlebury and the proposed EAB preparedness plan.
- Notification of community members well in advance of ash tree removal.
- Request a permanent presence in the right-hand menu of the Town of Middlebury HOME page.
- Utilization of existing community communication networks – FPF, Town’s website, newspapers, etc.
- Provide information on certified arborists, tree removal services and tree replacement options for homeowners.
- Work with schools and community groups to “spread the word”.

## Summary of Costs:

<b>Description of Cost</b>	<b>Cost</b>
Scheduled removal of healthy ash trees <24" DBH (currently 74 trees)	\$11872.50
Treatment with systemic insecticide of trees > 24" DBH or of particular aesthetic or historic value (currently 1-2 trees) starting when EAB has been detected within 10-15 miles of Addison County	\$1320.00
Replacement with appropriate native species 2 for 1 at \$600/tree*	\$88,800.00
Community Outreach and Education	\$500.00
<b>REVISED TOTAL</b>	<b>\$102,592.50</b>

\* cost of purchase, planting, and maintenance for first three years

## References

[Emerald ash borer aftermath forests: the future of ash ecosystems](#)

[Emerald ash borer invasion of North American forests](#)

[Emerald Ash Borer Information Network](#)

<https://epress.earlham.edu/sustainability/files/2015/11/maxresdefault.jpg>

[Coalition for Urban Ash Tree Conservation](#)

[Insecticide Options for Protecting Ash Trees from Emerald Ash Borer](#)

[Evaluation of Systemic Insecticides to Control Emerald Ash Borer  
Preparing Vermont Communities for EAB](#)

[Identify Emerald Ash Borer](#)

[EAB Cost Calculator](#)

## Local Resources

- Vermont Agency of Agriculture
- USDA APHIS – Plant Protection & Quarantine
- VT Department of Environmental Conservation
- Vermont Department of Forests, Parks and Recreation
- Urban and Community Forestry Program
- VT Forest Pest First Detector Program
- University of Vermont Extension
- Middlebury Tree Committee
- Middlebury College – *Trees and the Urban Forest* , Winter 2013
- Tim Parsons – Landscape Horticulturist, Middlebury College

## Appendix A

### Preliminary Planting List for EAB plan - December 7, 2016 v1

- Availability: list will vary depending on what is actually available on the ground at the nurseries
- Genera diversity: the planting list is a living document and will be revisited in consideration of not only genera and species diversity, but also age class.
- All trees are native to Vermont unless otherwise indicated .
- Certain other species may have different issues – overplanting, hardiness, maintenance, etc.

#### Small – between 20-30 ft

**American Hornbeam** Muscle wood (*Carpinus carolina*) - plant spring

**Japanese Lilac Tree** (*Syringa reticulata* “ivory silk”, “summer snow”) - plant spring, fall - non-native - plant sparingly due to overplanting

**Thornless Cockspur Hawthorn** (*Crataegus crus-galli* var. *inermis*, thornless form) - plant spring, fall

**Washington Hawthorn** (*Crataegus phaenopyrum*) - salt tolerant, Zone 4b, acid to alkaline soil - plant spring, fall - non-native

**Shadblow Serviceberry** (*Amelanchier Canadensis*) - plant spring, fall - must be single stemmed variety

**Apple Serviceberry** (*Amelanchier x grandiflora*) - plant spring, fall - non-native

**Amur Maackia** (*Maackia amurensis*) - non-native

**Trident Maple** (*Acer buergeranum* ) salt tolerant, Zone 6a, acid to alkaline soil - plant spring, fall - non-native - plant sparingly because 27% of public trees are from Maple genus

**Hedge Maple** (*Acer campestre*) - plant spring, fall - non-native - plant sparingly because 27% of public trees are from Maple genus

**Amur Maple** (*Acer ginnala*) - plant spring, fall - non-native - plant sparingly - plant sparingly because 27% of public trees are from Maple genus

**Harvest Gold Crabapple** (*Malus* 'Harvest Gold') - plant spring, fall - plant sparingly - 16% of trees in Middlebury are *Malus* genus

**Spring Snow Crabapple** (*Malus* 'Spring Snow') - plant spring, fall - plant sparingly - 16% of trees in Middlebury are *Malus* genus

#### Medium – between 30-45ft

**Yellowwood** (*Cladrastis kentuckea*) - plant spring - non-native - probably too high maintenance for municipal work

**Eastern Hophornbeam, Ironwood** (*Ostrya virginiana*) - plant spring

**Katsura Tree** (*Cercidiphyllum japonicum*) - plant spring - non-native

**LittleLeaf Linden, Basswood** (*Tilia Cordata*) - plant spring, fall

**Turkish Filbert** (*Corylus colurna*) - plant spring, fall

**Sargent Cherry** (*Prunus sargentii*) - salt tolerant, Zone 4b, acid to neutral soil - non-native  
– plant sparingly – might not be hardy enough

**Persian Ironwood** (*Parrotia persica*) - plant spring, fall - non-native

**Tree Filbert/Hazel** (*Corylus columna*) - plant spring, fall - non-native

**Autumn Blaze Maple** (*Acer × freemanii* 'Jeffersred') - plant spring, fall - plant sparingly because 27% of public trees are from Maple genus

**Red Sunset Red Maple** (*Acer rubrum* "Red Sunset") - plant spring, fall - plant sparingly because 27% of public trees are from Maple genus

**Sienna Glen Freeman Maple** (*Acer × freemanii* 'Sienna') - plant spring, fall – non-native  
- plant sparingly because 27% of public trees are from Maple genus

**Continental Honeylocust** (*Gleditsia triacanthos* var. *inermis*) - plant spring, fall - non-native

Large – greater than 50ft

**Shagbark Hickory** (*Carya ovata*) - plant spring - best in parks

**Swamp White Oak** (*Quercus bicolor*) - plant spring

**English Oak** (*Quercus robur*) - salt tolerant, Zone 5b, acid to alkaline soil - plant spring - non-native

**Saw-tooth Oak** (*Quercus acutissima*) - salt tolerant, Zone 5b, acid to neutral soil

**Northern Oak** (*Quercus rubra*) - plant spring

**Pin Oak** (*Quercus palustris*) - plant spring

**Burr Oak** (*Quercus macrocarpa*) - plant spring

**Tulip Tree** (*Liriodendron tulipifera*) - plant spring

**Ginkgo** (*Ginkgo biloba* 'Autumn Gold' or 'Presidential Gold - male only) - plant spring **American Sweet Gum** (*Liquidambar styraciflua*) (for wet areas) - plant spring - non-native - possibly not hardy

**Tupelo** (*Nyssa sylvatica*) - salt tolerant, Zone 5a, acid to neutral soil - plant spring

**Bald Cypress** (*Taxodium distichs*) - salt tolerant, Zone 5a, acidic soil only, wet - plant spring - non-native

**Common Hackberry** (*Celtis occidentalis*) - salt tolerant, Zone 3b, acid to alkaline soil - plant spring, fall

**Triumph Elm** (*Ulmus* 'Morton Glossy') - plant spring, fall - non-native

**Accolade Elm** (*Ulmus japonica × wilsoniana* 'Morton') - plant spring, fall - non-native

**London Planetree** (*Platanus occidentalis*) - plant spring, fall

**Sugar Maple** (*Acer saccharum*) - plant spring, fall - plant sparingly because 27% of public trees are from Maple genus