March
2021

Emerald Ash Borer
Ash Tree
Management Plan

INTRODUCTION AND BACKGROUND

The Emerald Ash Borer was first discovered in the US in 2002 in the Detroit metropolitan area. Data collected through dendrochronology suggest that the pest was likely established in the Detroit area at least as early as the early 1990s. EAB quickly spread throughout the Midwest over the decade following its first detection killing millions of trees. It spread farther to southeastern states and up to New England, and as of July 2020, has been detected in 35 states (Emerald Ash Borer Info). The first EAB detection in Vermont was recorded in early 2018 in the town of Orange. It has since been detected in numerous other locations throughout the state and it is anticipated that the pest will become prolific over the next several years; eventually killing every ash tree not inoculated to protect them against EAB infestation. The prospect of the loss of all ash trees in the state carries with it potentially significant ecological, recreational, economic, quality of life and public safety implications.

VTrans maintains over three thousand miles of roads statewide and has a right of way (ROW) along each of them. The VTrans ROW encompasses a variable width of land adjacent to State roads. Trees within and adjacent to the ROW have the potential to impact the safety of the traveling public should they fall on the road. VTrans is implementing this management plan to mitigate potential effects to State transportation infrastructure and to minimize risk to safety for the traveling public.

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EMERALD ASH BORER BIOLOGY

The emerald ash borer, *Agrilus planipennis* Fairmaire, is a beetle in the family Buprestidae, or jewel beetles. It is native to northeastern China, Korea, and eastern Russia, and is believed to have been introduced to the United States from China. EAB has a one or two year life cycle. Adult beetles feed on the leaves of ash trees, but the most significant damage to ash trees is caused by the larval stage of the beetle. Adult female emerald ash borers lay their eggs under the bark of ash trees. Eggs hatch after two to three weeks, and larvae bore through the bark of the tree into the phloem and cambium, which are responsible for nutrient transport and new growth within a tree trunk. EAB larvae feed within these inner layers of bark from mid-summer to fall, then overwinter within the outer bark or outer sapwood (Herms & McCullough, 2014).

image from vtinvasives.org

The larvae create serpentine feeding galleries that disrupt a tree's ability to transport nutrients and water. In a one-year life cycle, the larvae will pupate in the spring, transforming into adult beetles that emerge from the tree from May through August. In a two-year life cycle, the larvae will feed for a second summer before emerging as adults. When adult beetles emerge from a tree, they leave two to three-millimeter D-shaped holes in the bark. Adult beetles live for three to six weeks outside of the host tree (Herms & McCullough, 2014).

The adult beetle is approximately 6 to 13 millimeters in length and metallic green in color. Mature larvae are approximately 26 to 32 millimeters in length. They are cream-colored and have ten flattened, bell-shaped abdominal segments. Eggs are roughly 1 millimeter long by 0.6 millimeters wide and are white when laid but quickly turn an amber color (USDA, 2019).

image from vtinvasives.org

Emerald ash borers are capable of flight, however; flight has not been the primary vector for spread of the pest across the US. The transportation of wood products, primarily firewood, rather is believed to be the method by which EAB has spread regionally (Herms & McCullough,

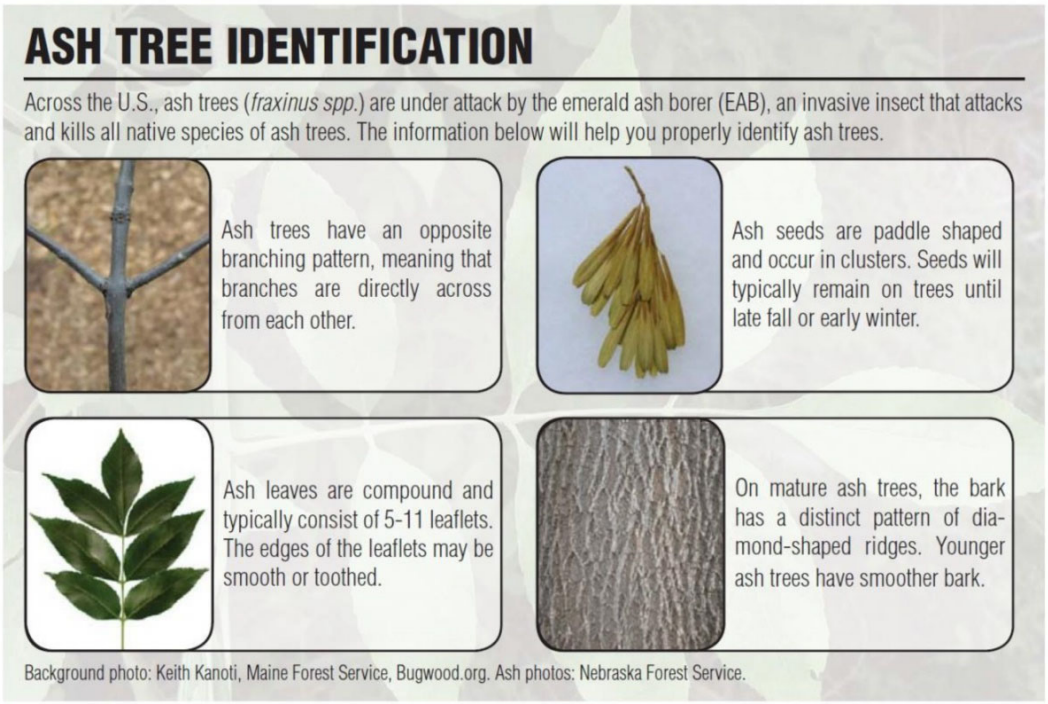
2014). For this reason, a federal quarantine is in place that regulates the movement of all firewood, nursery stock, green lumber, chips, and any other material living, dead, cut or fallen from any state with an infestation. These materials may not be transported from a state under quarantine to another state without obtaining a permit (USDA, 2020).

The population spread of EAB in other states has demonstrated that what begins relatively slowly for the first couple of years after initial infestation, increases rapidly with explosive growth evident by years five and six.

ASH TREE INDENTIFICATION

Three species of ash trees are native to Vermont: white ash, green ash, and black ash. Ash trees have an **opposite bud and branch arrangement** where these features are located directly across a twig or limb from each other and are not staggered. The leaves of ash trees are **compound and composed of five to eleven leaflets**. The mature bark on green and white ash trees has characteristic **diamond shaped ridges**, while the bark of a mature black ash tree is **flaky and corky** without a distinctive pattern. The fruit of ash trees is an **elongated oval-shaped samara**. White ash trees are typically found growing on drier upland sites, green ash on intermediate to wet sites, and black ash on wet sites. For additional information see *Ash Tree Identification*—Michigan State University Bulletin E-2942.

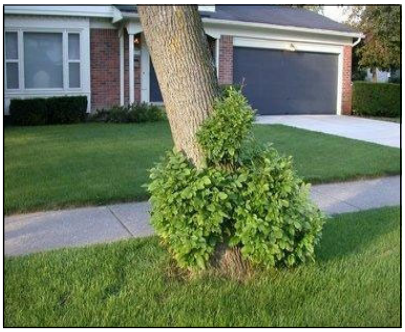
White Ash *Black Ash* *Green Ash*



SIGNS OF EAB INFESTATION

There are many visual indicators that can be used to determine whether an ash tree may be infested with EAB. Signs of infestation include the following:

- Canopy dieback
- Epicormic branching (dense, leafy shoots around base of tree and/or branches)
- Increased woodpecker activity and blonding of bark from woodpecker flecking
- Flaky, peeling, cracked, crumbling bark
- Presence of serpentine larval feeding galleries within inner bark
- D-shaped exit holes in bark
- Presence of larvae in inner bark



Epicormic branching

D-shaped exit holes

Serpentine larval galleries

ASH TREE MANAGEMENT

As EAB continues to proliferate within Vermont, managing ash trees within VTrans ROW is needed to minimize the safety risk of the traveling public. Ultimately, the management of ash trees will primarily rely on cutting and removal options, which can essentially be categorized as cutting infected and hazardous trees later, or preemptively cutting healthy trees now.

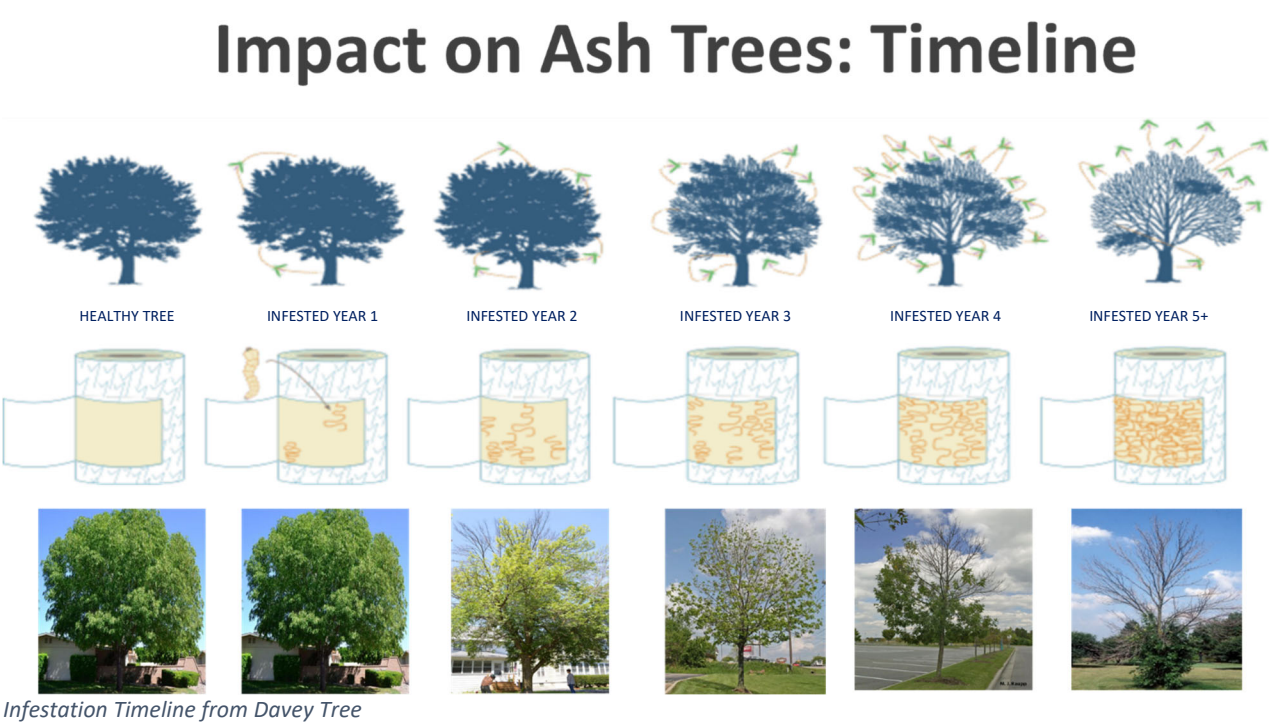
OPTIONS

Option 1 – No preemptive cutting

In this approach, no preemptive removal would be implemented for ash trees and nature would be allowed to take its course. This strategy requires no immediate action and has no cost up front. However, ash trees infected with EAB become progressively more brittle, making them more susceptible to failure and thus more hazardous to the traveling public. Infected trees also become more dangerous and costly to remove. Given the widespread ash tree mortality that is predicted in Vermont, postponing the management of ash trees until they are infected is much less desirable.

Option 2 – Preemptive removal of ash trees within the ROW

This option would involve removing all ash trees within the ROW, with the goal of doing so, preemptively, prior to infestation. While the upfront cost and effort associated with this strategy is significant, preemptive removal is the best way to safely manage ash trees and prevent them from becoming hazardous and even more costly to remove.



Infestation Timeline from Davey Tree

STRATEGIES

Within the overall goal of preemptive removal, there are several different strategies that VTrans can take to manage roadside ash trees, some of which are already underway. The strategies are multi-faceted and are not mutually exclusive. They include the following:

- Education and Training to "Slow the Spread"
- Revision of VTrans Maintenance District Tree Cutting Environmental Guidance to include Ash Trees
- Prioritization
- Inventory
- Removal (including appropriate disposal)
- Preservation of Select High-Value Ash Trees

Education and Training to "Slow the Spread"

It is widely recognized that EAB will ultimately have a presence throughout the entire state and, once established, EAB populations are expected to grow rapidly. Therefore, taking measures to prolong that inevitability will afford VTrans more time to preemptively remove ash trees prior to them becoming infected. The strategy of minimizing or slowing the spread of EAB within VTrans has been implemented through the education and training of District and Construction staff. This training has included awareness, identification and best management practices recommended by the Vermont Department of Forests, Parks, and Recreation in their Slow the Spread documents (Slow the Spread).

The expectation is that these practices, as well as Federal Quarantine regulations, will be followed by Operations during activities that may involve tree cutting.

In addition, all construction projects now include contract provisions that require adhering to the "Slow the Spread" guidelines.

Designation of Ash Trees as Moderate or High Risk Trees

The VTrans Maintenance District Tree Cutting Environmental Guidance, 2020 revision, includes an update to list all ash trees growing within the VTrans right of way as moderate risk trees. Ash trees shall be managed accordingly.

Prioritization

Given the enormity of the task to remove all ash trees within the ROW, prioritization is necessary to focus our efforts in areas of greatest need. The two primary factors to be considered in developing an approach include: current EAB "Infested Areas" and roadway functional classification.

> **EAB Infested Area** - Areas of EAB presence can be accessed through the online map available on the VT Invasives website (VT EAB Map). This map labels areas within a 5-mile radius area around a known EAB detection as Confirmed Infested Areas, with another 5-mile buffer around those areas as High Risk Infested Areas, collectively

considered the “Infested Area Zone”. For the purpose of VTrans prioritization, all areas within the Infested Area zone shall be deemed a higher risk. As more EAB detections are made, thereby continually expanding the infested areas, those areas of earliest detection will be given a more immediate priority.

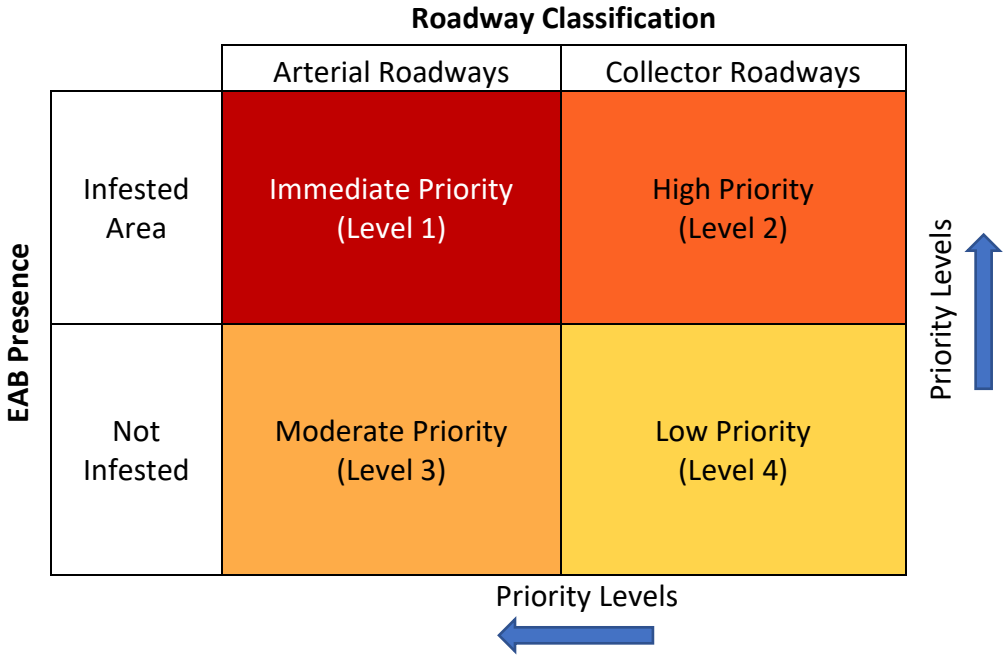
Roadway Functional Classification – Further prioritization shall be based on roadway classification. “Arterials” connect urbanized areas and serve corridor movements having trip length and travel density characteristics of substantial statewide travel whereas “collectors” gather traffic from local roads and funnel it to the arterial network. Arterial roadway segments are therefore a higher priority than collector roadway segments. These classifications can be further categorized as follows:

Principal Arterial: Interstate - Designated as interstate by Secretary of Transportation, comprise national system of interstates. Important for long-distance travel; connect major urban areas of US.

Principal Arterial: Other - Not access controlled.

Minor Arterial - provide service for trips of moderate lengths within geographic areas that are smaller than the higher arterials, and offer connectivity to the higher Arterial system.

Major Collectors are longer in length with lower connecting driveway densities and higher speed limits than **Minor Collectors** (USDOT, 2013).



Inventory

The identification of ash trees within the ROW and then cutting prior to them becoming a higher risk is the crux of this management plan.

The first step is to identify and inventory the ash trees. The following table presents several different methods:

Inventory Method	Pros	Cons	Cost
Rapid field inventory by abbreviated windshield survey	• Relatively quick and easy • Could be conducted by trained district personnel who are already out driving the roads • Tracking ash trees by road segment	• Likely to miss some trees • Doesn't provide detailed information about specific location, size or health of trees	$
Detailed field inventory using GPS*	• Accurate locations of individual trees • Detailed information on tree size and health collected	• Time consuming • May delay removal efforts	$$
Remote sensing method of inventory	• Efficient inventory technique • Requires limited field personnel	• Data collection, processing and analysis are very expensive • Time consuming • May delay removal efforts • Variable accuracy documented in literature	$$$

* Municipalities, working with their regional planning commissions and the Department of Forests, Parks, and Recreation have been conducting similar detailed field inventory using GPS. Information collected using this method is fed into an aggregated dataset of "Roadside Ash Inventory" that is available to view on ANR's Natural Resource Atlas. Given that this work at the municipal level has already begun and the applications for data collection have been developed, it is recommended that VTrans follow similar methods, if possible, to allow for shared data and potential collaboration.

Removal

Once the ash tree inventories within a region, district, or corridor have been conducted, removal efforts can begin. There are numerous ways of addressing this effort that include:

- Using District personnel and forces, as available
- Incorporating tree cutting as part of other programmed projects in construction
- Developing a stand-alone safety project such that tree cutting may be implemented regionally via Indefinite Delivery/Indefinite Quantity (IDIQ) contracts

Coordination with utility companies may also assist in focusing removal efforts. In locations where the VTrans ROW is adjacent to, or utilized by utility companies, some of the tree cutting may already have been conducted. In locations where further removal efforts are needed,

there may be opportunities to reduce mobilization and contractor's travel costs through cost sharing with the utility companies.

Preservation of Select High-Value Ash Trees

In some cases, there may be ash trees that are considered of such high value that they warrant preservation. This is may be trees located in public parks, on village greens, of historic significance or exceptionally large. In these cases, annual treatment via inoculations of the individual trees with insecticide would be considered. It is not expected that there would be many of these trees within the State ROW, however this is an option that VTrans may consider, in conjunction with the specific municipalities.

ADDITIONAL CONSIDERATIONS

Public Outreach

In advance of conducting widespread tree cutting of otherwise healthy trees, it is recommended that VTrans inform the public of these ash tree management efforts. Outreach efforts may include press releases, social media updates, variable message boards, or other signage. The messaging will inform the public about why trees are being cut along roads and could provide updates on cutting locations and schedules.

Management of Wood Waste

The wood waste generated during the removal process will need to follow the Slow the Spread Guidance.

Other regulatory

The timing of removal efforts will need to be evaluated to ensure compliance with federal and state requirements, including but not limited to, adherence to the Indiana and Northern Long-Eared Bat Guidance for all VTrans Projects and Maintenance Activities, latest revision. Environmental coordination will follow the Hazard Tree Guidance document, which describes the review process.

IMPLEMENTATION SCHEDULE

Management Action	Description	Responsibility	Timeframe	Status
Education	Initial "Slow the Spread"	Biologists & Construction Staff	Fall 2019	Complete
	Ash Tree Identification and Inventory	Biologists and Landscape Architect	Spring 2021	
VTrans Maintenance District Tree Cutting Environmental Guidance	Update Hazard Tree Guidance to designate ash trees as hazard trees	Green Infrastructure Engineer	Fall 2020	Complete
Establish VTrans workgroup	Cross-division workgroup to strategize and plan implementation efforts	Division Directors	Spring 2021	
Prioritization	Create map/table of prioritization area based on Infested Area and Roadway Classification (Levels)	EAB Workgroup with GIS Team support	Spring 2021	
Inventory	Level 1	Arborist/Forester consultant(s)	Spring 2021 - Fall 2021	
	Levels 2-4	Arborist/Forester consultant(s)	Fall 2021-Fall 2022	
Develop removal contracts		EAB Workgroup, PM & Contract Admin	Spring 2021	
Removal	Level 1	Tree Removal contractor(s)	Fall 2021 – Fall 2022	
	Levels 2-4	Tree Removal contractor(s)	Fall 2022 – 2026	
Preservation of High-Value Ash Trees		Landscape Architect & EAB Workgroup	As needed	

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