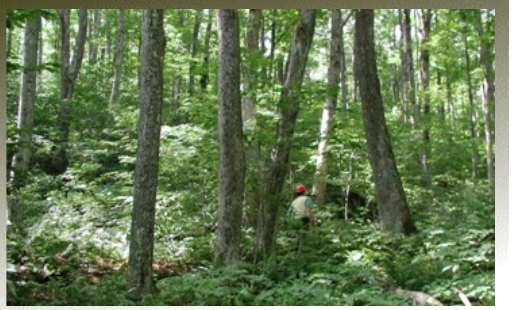
Vermont
Forest Health



Ash Management Guidance for Forest Managers

Department of Forests, Parks, & Recreation
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Executive Summary

Emerald Ash Borer (EAB), a non-native wood-boring beetle, attacks all native ash (*Fraxinus*) species. The control options for EAB in forestland are limited. Research is being conducted to develop new management tools and understand why some trees have survived EAB. Experimental Slow-Ash-Mortality (SLAM) techniques and parasitoid wasps released for bio-control show promise in reducing EAB populations. EAB will not be eliminated through widespread ash tree removal. This has been unsuccessful in other states.

A federal quarantine now restricts the movement of nursery stock, green lumber, chips, and other woody material of the genus *Fraxinus*, as well as any non-coniferous firewood from EAB regulated areas. Ash logs have been allowed to move within quarantined areas. Shipping logs from within a quarantined area to a mill outside the area is possible, but requires compliance with quarantine restrictions. Moving firewood is the primary human-caused activity that increases the rate of spread of the insect.

Symptoms of EAB include woodpecker activity, dead branches near the top of a tree, D-shaped exit holes, bark splits exposing S-shaped tunnels, and epicormic shoots growing from the lower portion of trunk.

Management Goals

Plan ahead *now* for when EAB is detected in Vermont. Focus on mitigating the effects of ash loss on ecosystem health, forest productivity and economics by maintaining forests diverse in structure and species composition. Forest landowners should consider incorporating the following long-term management options:

1) **Maintain ash as a component of the forest**;
2) **Promote a diversity of native species**; **and**
3) **Conserve the economic value of ash**.

Given the information we currently have regarding EAB, here are some suggested strategies for dealing with the insect and ash trees in Vermont:

- Consider legitimate long and short-term risks. Although EAB will kill trees when it arrives in Vermont, it has not been detected here yet, and may not spread rapidly when it is.
- Know where ash trees exist on properties you manage. Evaluate the condition of ash regularly.
- Do not preemptively liquidate and eliminate ash from the forest mix. Where appropriate, continue to manage and regenerate ash.
- Focus growth on a variety of species. Where ash exceeds 20% of basal area, reduce the ash component. Residual stand-wide basal area targets should be consistent with appropriate silvicultural guides. Retain other species in greater numbers to maintain adequate stocking if removing substantial amounts of ash.
- Spread the "Don't move firewood!" message to slow the human-caused spread of EAB.
- Know where EAB populations exist. Detection maps are regularly updated at www.emeraldashborer.info/files/MultiState_EABpos.pdf . If you think you may have seen signs of EAB, report it. Call the EAB hotline at 1-866-322-4512.
- Management practices that eliminate ash could be a greater threat to ash than EAB itself. Survival of these species ultimately depends on retaining genes that help ash tolerate EAB, and seedlings or a fresh seedbank to populate a new generation.

The Department of Forests, Parks and Recreation has a policy statement regarding EAB and ash management on properties that are enrolled in Vermont's Use Value Appraisal Program (UVA). This is available at www.vtfpr.org/resource/for_forres_useapp.cfm.

In advance of a known emerald ash borer (EAB) infestation in Vermont, but with this insect on the horizon, there are challenging decisions to make in both public and private forest management. There's a lot of uncertainty, but we do know quite a bit about ash and we are rapidly learning more about EAB. The guidance for management presented here is based on what is currently known, in the context of forest ecosystem health as well as the marketability of ash sawtimber. It will need revision when there's new information, developing technology, or as the EAB infestation expands.

Emerald ash borer adults are 1/2" long and may be flying from late May until early September.

Identification and Current Status of Emerald Ash Borer

Emerald ash borer is a non-native, wood-boring beetle that can attack all native ash (*Fraxinus)* species. This insect was first found in North America, in 2002, in southeastern Michigan and adjacent Ontario. It likely arrived in the early 1990s on solid-wood packing material from Asia. It has spread quickly, largely due to human movement of firewood. To date, twenty-one states and two Canadian provinces have confirmed EAB infestations, although there are still many uninfested ash trees, of all sizes, in Michigan and other affected states.

EAB adults are 1/2-inch long and metallic green. They emerge through small (1/8 inch) D-shaped holes starting in late May and may be flying until early September. Moving wood products during this time of year presents the greatest risk for spreading the insect to previously uninfested trees and/or sites. The larvae may be found year round. They bore through tree bark, and feed in the cambium, creating long serpentine galleries which get wider as the insects grow. This feeding pattern interrupts the tree's vascular system, eventually girdling and killing it. Adult beetles are more common in sunlit portions of the crown, so initial damage often occurs in upper branches, making early detection more difficult.

EAB larvae feed in the cambium, creating serpentine galleries.

EAB can kill stressed and healthy ash trees greater than 1 inch in diameter. In established infestation areas, most die within two to three years of becoming infested. Up to 3% of ash may survive on sites with heavy mortality. Some of these "lingering ash" show evidence of bark healing, suggesting possible host resistance.

Emerald ash borer will not be eliminated through ash tree removal. Eradication was tried unsuccessfully in Michigan, southern Ontario, & Maryland.

Individual landscape trees can be protected with systemic insecticides, but there are currently no practical control options for EAB in forestland. In the future, however, additional options may become available. Research is being conducted to develop new management tools, establish biocontrols, and understand why some trees have survived EAB.

Experimental Slow-Ash-Mortality (SLAM) techniques, which include removing infested trees before the beetles emerge, show promise in reducing the rate of EAB spread to new locations. In addition to native parasites and predators that have been found feeding on EAB, parasitoid wasps from Asia have been released in many of the infested states as part of an operational biological control program. In study sites, parasitism has slowed the rate of EAB population growth.

Emerald ash borer will not be eliminated through widespread ash tree removal. This has been tried time and again, including attempts in Michigan, southern Ontario, and Maryland. Because these efforts have been unsuccessful, the State of Vermont is not likely to attempt to eradicate the insect.

EAB has not been detected in Vermont.

To slow the spread of EAB, a federal quarantine restricts the movement of materials which might harbor the insect. Such materials are "nursery stock, green lumber, chips, and other woody material of the genus Fraxinus, plus any non-coniferous firewood and the insect itself, in any of its life stages". Ash logs have been allowed to move freely within quarantined areas. Shipping logs from within a quarantined area to a mill outside the area requires compliance with quarantine restrictions. More information is available at 802-879-5687 or: www.aphis.usda.gov/publications/plant_health/content/printable_version/emerald_ash_borer_faqs.pdf .

Firewood transport is a primary method of human-aided EAB spread.

Thus far, strategies to address EAB in Vermont have focused on detection, such as using purple panel trap surveys, on regulatory activities, and on public awareness campaigns to assist with detection and prevent human-assisted movement of the insect. Outreach efforts have emphasized the "Don't Move Firewood" message, as firewood transport is a primary method of human-aided EAB spread.

Importance of Ash and Impacts of Emerald Ash Borer

EAB is expected to become established in Vermont and kill ash trees, resulting in detrimental impacts on forest ecosystems and community treescapes as well as economic losses. According to recent FIA data, there are approximately 150 million ash trees throughout Vermont. Over 100 million ash trees in Vermont are sawlog size (>11 inches dbh). Currently, ash represents approximately 6% of the standing sawtimber volume in Vermont.

Ash trees are important ecologically. In Vermont, white ash is an important component of many upland forested natural communities, especially those that have calcareous or enriched soils. In ground water seepage swamp communities, black ash can be a dominant species, and is an indicator of mineral enrichment. Green ash is flood tolerant. It is closely associated with floodplain and clayplain forests of the Champlain Valley. Trees in these areas help stabilize the water table and maintain flood resiliency.

Green ash occurs in floodplain forests, where trees help stabilize the water table and maintain flood resiliency.

Ash provides for many wildlife needs, including:

- Browse for deer.
- Roosting sites for bats under the loose bark of dead and dying ash trees.
- Cavities for nesting, roosting, feeding or perching, which regularly develop when tops are broken.
- Seeds that are a preferred food for a variety of birds, including grosbeaks, blackbirds, cardinals, purple finch and waterfowl.

EAB threatens other values. Ash, especially green ash, has been widely used for tree planting due to its ability to tolerate urban conditions. In areas of the country where ash mortality has been widespread, consequences include decreased property values, wood supply disruptions, changes in hydrology, and impacts on the use of ash for traditional crafts.

There are other causes of ash health decline in Vermont. Ash is particularly susceptible to fluctuating water availability because it is ring porous. Fewer vessels move water in ring porous trees, and they are therefore more prone to cavitation. Ash decline is common on droughty sites, as well as wet or shallow soils where root depth is limited. The disease known as Ash Yellows, caused by a microscopic phytoplasma, is common in parts of southern and western Vermont. Trees vary widely in ash yellows tolerance. Abnormal clusters of twigs called "witches' brooms" are diagnostic for this disease, although not always present on infected trees.

Symptoms of EAB and Detection

It is difficult to determine whether an ash tree is infested with EAB because recently attacked trees may look healthy.

Woodpecker activity, especially on a live tree, is often the first sign that a tree might be infested with EAB. Look for patches of smooth outer bark where it has been flaked off, irregular holes, and bird toenail scars. Other symptoms of EAB include dead branches near the top of a tree, D-shaped exit holes, bark splits exposing S-shaped tunnels, and epicormic shoots growing from the lower trunk. Unlike the bushy witches' brooms caused by ash yellows, epicormic shoots retain the strong apical dominance typical of ash.

Woodpecker activity on a live tree is often the first sign of infestation. Look for patches of smooth outer bark (right), irregular holes and bird toenail scars (left).

Management Goals

When EAB is initially found in Vermont, most ash in the state will be years away from being infested. However, now is the time to plan ahead, evaluate potential impacts, and develop strategies which capitalize on the remarkable resiliency of Vermont's forests. With this in mind, forest management should focus on mitigating potential effects of emerald ash borer on ecosystem health and stand productivity, using strategies that do not eliminate ash, but rather create a more diverse forest in both structure and species composition.

The goals of all silvicultural treatments typically include maintaining site quality, protecting water resources, and attending to forest health and productivity. Most times, improving access infrastructure and increasing the ratio of acceptable growing stock basal area to total basal area are also goals. Treating an area to reduce exposure to loss by removing ash trees is not a reason to ignore the many other benefits of careful stewardship.

Forest management should focus on strategies that create a more diverse forest in both structure and species composition.

In light of the fact that Vermont has no known EAB infestations, the following long-term management options are recommended: **1) maintain ash as a component of the forest, 2) promote a diversity of native species, and 3) conserve the economic value of ash.** The Vermont Forest Health leaflet, "Emerald Ash Borer: Information for Vermont Landowners" may help consulting foresters provide answers to clients in management planning. (www.vtfpr.org/protection/documents/EABLandownerFAQs_111011.pdf)

The recommendations in this document were developed with timber management in mind. Where timber is not an objective, such as on sites with limited access or sensitive natural communities like seepage swamps or floodplain forests, some actions may still be warranted. Control of non-native invasive plants in particular may offer significant benefits to sensitive or unique areas. For more information about appropriate management of these sites, contact your County Forester.

Goal #1 – Maintain ash as a component of the forest.

Management practices that eliminate ash could be a greater threat to ash than EAB itself. Survival of these species ultimately depends on retaining genes that help ash tolerate EAB, and seedlings or a fresh seedbank to populate new generations.

Though there is substantial mortality in states that have been infested with EAB, some ash trees have survived. It's possible that the next generation will fare better. By the time regenerating trees have grown to 1 inch or more in diameter – large enough to be infested – introduced natural enemies should be more widely established. Early data on the impact of introduced wasp parasites indicate that these biocontrols help to reduce EAB populations, and could allow the survival of more EAB-tolerant ash.

Management practices that eliminate ash could be a greater threat to ash than EAB itself.

Though there is substantial mortality in states that have been infested with EAB, some ash trees have survived.

Choose healthy ash on good sites for retention.

- Focus retention on sites with deeper soils not prone to drought.
- Uninfested, rapidly growing trees will increase in volume and/or grade.
- Vigorous ash trees survive longer than others, once infested with EAB.

Where site conditions and landowner objectives allow, encourage ash to regenerate.

- Ash seed is viable in the soil for 2-4 years. Good seed years are about three years apart.
- Keep some overstory ash trees to continue replenishing the seed bank.
- Plan for canopy opening sizes and associated light regimes that could favor survival of white ash regeneration.

Retain ash to provide wildlife benefits.

- Consider ash as a seed source, and unhealthy ash trees as potential future snags. Dead trees may be used for nesting, feeding and/or as a perch site.
- Where practical, and with due consideration of safety, retain ash already functioning as cavity trees.

Goal #2 – Promote a diversity of native species.

Many woodlands can benefit from a well-planned harvest in which native tree species diversity is maintained or enhanced. This will promote development of a forest that will remain ecologically and economically productive when ash mortality occurs.

Promote native tree species diversity in all diameter classes.

- Base decisions on accurate, up-to-date stand inventories.
- Where ash exceeds 20% of basal area, reduce the ash component to increase growing space for a variety of species. Ash distribution is irregular in many stands. The target percentage of residual ash can be higher in enriched pockets.

- Remove low-vigor trees to improve overall stand productivity. Select trees with ash yellows witches' brooms for removal.
- Residual stand basal area targets should be consistent with appropriate silvicultural guides. Retain other species in greater numbers if necessary to maintain adequate stocking.
- Multiple harvest cycles may be required to reduce the ash component to desired levels in stands or portions of stands with high concentrations of ash.

Encourage regeneration of a variety of native species.

- Release advanced regeneration of desirable native species under pockets of mature or low-vigor ash.
- Mid-sized canopy gaps, especially those between 120 feet in diameter (1/4 acre) and 235 feet in diameter (1 acre), may favor ash regeneration as well as other intermediate species.

Control non-native invasive plants. Plants in the understory will respond to additional sunlight reaching the forest floor as ash trees in the overstory die. Focus on establishing desirable species prior to the arrival of EAB. Monitor for invasive plants, like honeysuckle, barberry, and buckthorn, which prefer the rich sites favored by ash. They produce prolific seed, and can persist in the understory for many years, excluding more desirable native species.

- Survey for invasive plants and incorporate invasive plant management into forest management plans.
- Remove new populations before they spread. Treatment is cheaper and more effective when populations are still small and isolated.
- Where practical, pre-treat invasive plant infestations before conducting timber harvest activities and after when necessary.
- For more information on how to survey for and treat invasive plants visit www.vtinvasives.org/plants/prevention-and-management .

Select trees with ash yellows for removal. Unlike epicormic shoots (right), which retain the strong apical dominance typical of ash, ash yellows witches' brooms (left) are bushy.

Goal #3 – Conserve the economic value of ash; don't panic.

The threat of EAB makes it riskier to retain larger diameter ash trees intended for timber harvest. However, there may be the potential for increased growth and value gain before EAB arrives. Small sawtimber trees with good form and vigor have the greatest potential to increase in grade and value. This is especially true for stands far from an EAB infestation, and if efforts to slow the spread of EAB are successful. In addition, panic cutting has proven to upset local and regional ash product markets and local economies. This is due to depressed stumpage prices related to excessive supply.

Review diameter objectives at which trees will be considered "economically mature".

- Base diameter objectives on the silvicultural system being used, site quality, stand condition, management objectives, and markets. These diameter objectives should be broad goals to which trees can be grown, not necessarily diameter limits.
- In order to achieve the highest economic value for ash logs, tree dbh must often be 16-20 inches or larger. For many Vermont mills, the minimum scaling diameter for the top ash sawlog grade is 14-16 inches on the small end. Markets and specifications change over time so it is important to stay in touch with local mills and their current specifications.

- Reconsider 18- or 20-inch diameter objectives where quick response – easy access, available loggers etc. – to changing ash condition will not be feasible. Given concerns about EAB and other factors affecting ash health, reducing ash diameter objectives to 16 inches may be reasonable.
- Resist setting unnecessarily low targets. Support the capacity of local sawmills to purchase high-quality logs over the long-term.

Ash logs can be sold once EAB appears.

- Preemptive salvage has sometimes flooded ash markets, depressing sawlog prices. When such "panic cutting" subsided, supply dropped and prices for ash timber rose. New York State reports that ash sawtimber markets have generally remained robust despite their EAB infestation.
- In states with EAB, regulating agencies have worked with industry to facilitate wood product movement from quarantine zones. For example, compliance agreements have allowed sawmills to freely accept ash logs during the winter, provided they are debarked and sawn before spring when EAB emerges.
- EAB attack does little to degrade ash wood in living trees. Standing trees should still have value as sawlogs for a year or more following infestation and during the early stages of EAB-related decline.

Ash logs can be sold once EAB appears. Compliance agreements have allowed sawmills to accept ash logs in the winter.

Know when EAB is close.

- Some ash in Vermont are 30 miles from known EAB infestations, but most are a lot farther away. In Michigan, if EAB is over 5 miles away, impacts on tree growth and survival aren't expected for about 10 years. In New York, ash over 10 miles from EAB is considered in the lowest risk area, with at least 5-10 years before EAB will arrive without human assistance.
- Detection maps are regularly updated at www.emeraldashborer.info/files/MultiState_EABpos.pdf.
- Install trap trees to monitor properties for EAB. Trees are girdled in the spring, cut in late fall, and peeled to look for signs of the insect. Stay "in the loop" by becoming a Forest Pest First Detector. See more details at www.vtinvasives.org/group/eab-girdled-trap-trees.

If you think you might have EAB, report it. Collect and/or photograph any suspect insects. Collected specimens can be stored in the freezer. If you can't reach someone at the contact numbers below, call the EAB hotline at 1-866-322-4512. Don't spread potentially infested materials. Visit www.vtinvasives.org/tree-pests/report-it for more information.

Monitor properties for EAB by installing girdled trap trees in the spring, and peeling them to look for the insect in late fall.

Websites for More Information

USDA APHIS Emerald Ash Borer Information Page
http://www.aphis.usda.gov/plant_health/plant_pest_info/emerald_ash_b/index.shtml

USDA APHIS EAB Quarantine Map Link
http://www.aphis.usda.gov/plant_health/plant_pest_info/emerald_ash_b/downloads/multistateeab.pdf

Emerald Ash Borer Information (a collaborative website providing information related to EAB)
http://www.emeraldashborer.info/index.cfm

Vermont Invasives: This website provides a landing page for Vermonters interested in learning more about invasive insects, plants and pathogens. In addition, the website is designed to guide visitors to the appropriate place to learn more and become involved in various monitoring, management and outreach efforts. http://www.vtinvasives.org/

Vermont Dept of Forests, Parks, and Recreation, Non-Native Forest Pests
http://www.vtfpr.org/protection/forestpestsfrontpage.cfm

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FORESTS, PARKS & RECREATION VERMONT AGENCY OF NATURAL RESOURCES

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Caledonia, Orleans & Essex Counties.....	St. Johnsbury (802) 751-0110

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