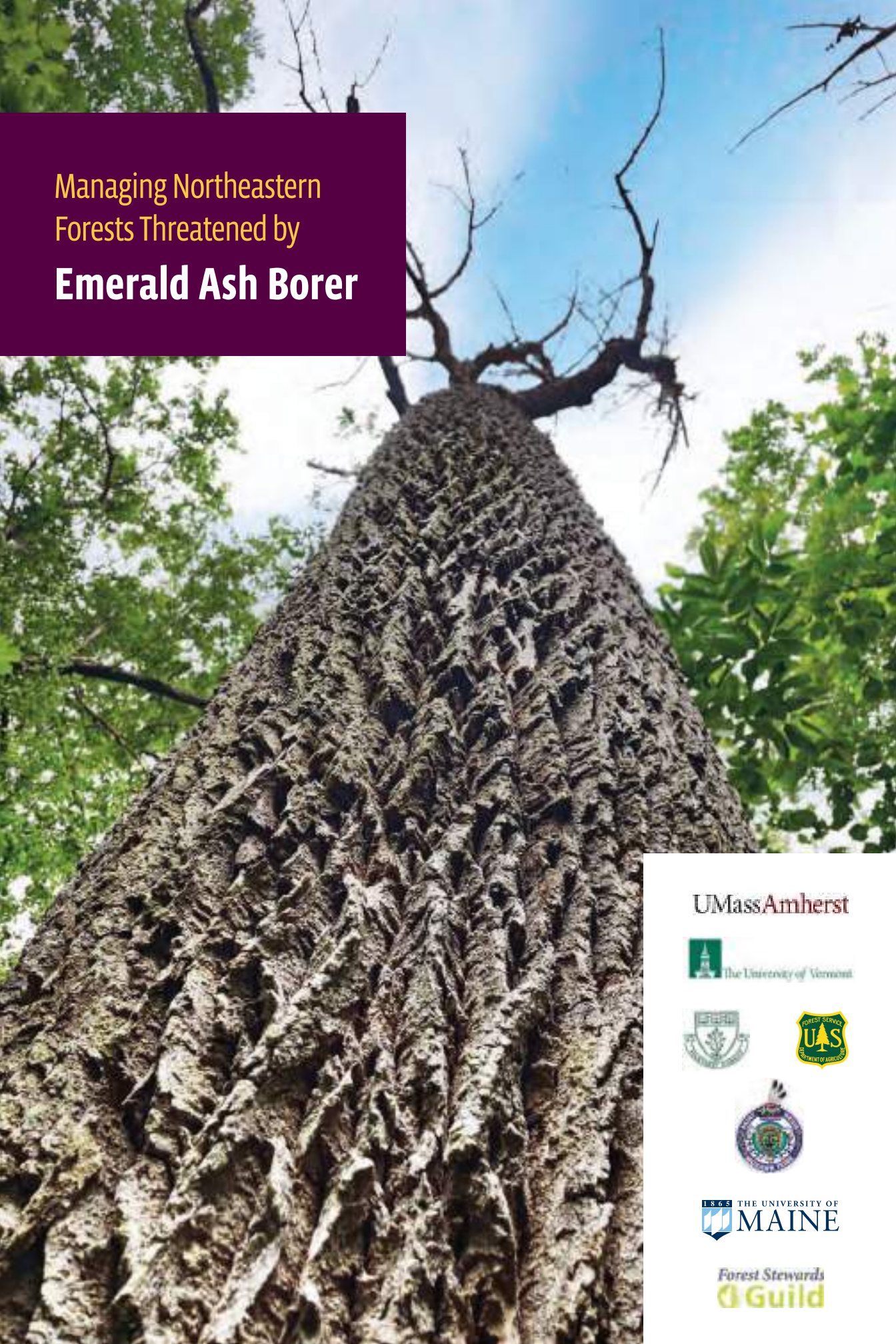

Managing Northeastern Forests Threatened by **Emerald Ash Borer**

UMassAmherst

The University of Vermont

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The decisions we make about our response to EAB will determine the benefits our forests continue to provide. Our decisions will also be the difference as to whether our ash species disappear from our landscapes forever or remain a part of our northeastern forests for generations to come.

Photos: (cover) Nathan Siegert; (p. 1) Anthony D'Amato

There are adaptive strategies available to address the loss of ash from our forests as well as to help ash species survive EAB.

Introduction

The forests of the Northeast have an impressive diversity of tree species, which in turn helps support an impressive diversity of wildlife and organisms.

Photo: Dave Orwig

Each species plays a unique ecological role within our forests and also provides important cultural value, including to the Indigenous communities tied to the region's forests for millennia. Maintaining this wonderful diversity of species within our forests is essential to sustaining and honoring the full suite of ecological, cultural, and economic benefits they provide us.

Over the last few decades, our forests have been facing increasing challenges from non-indigenous insects and pathogens (NIIP). A result of global trade, NIIP typically enter the United States in wood material used for shipping and on live plants. NIIP from other continents can spread here due to similar climate and vegetation of those with common latitudes. Once here, these NIIP can escape into the natural environment. Because these NIIP haven't evolved in the northeastern United States, there are no natural predators to keep their populations in check, and our native tree species have not evolved natural defenses to minimize their impacts. Since NIIP lack natural checks, they can spread through forests, resulting in significant tree mortality. NIIP damage tends to be highly selective, targeting trees of a certain species. Although the land remains forested after the NIIP have killed their host trees, the forest has been altered, simplified in a way that affects its resilience and ability to provide benefits, particularly those uniquely tied to the affected species.

The emerald ash borer (EAB) is one such NIIP. The impacts of EAB have been and will continue to be significant on our northeastern ash species. At this point, EAB is firmly established throughout our region. While that reality is out of our control, the way in which we respond to EAB is something that we can control. The decisions we make about our response to EAB will determine the kinds of benefits our forests will continue to provide. Our decisions will also be the difference as to whether our ash species disappear from our landscapes forever or remain a part of our northeastern forests for generations to come, continuing to provide their unique ecological and cultural benefits.

There are adaptive strategies available to address the loss of ash from our forests as well as to help ash species survive EAB. The goal of this publication is to give those making decisions about the stewardship of forests—landowners, foresters, loggers, conservation organizations, and community leaders—the information they need to address the impacts of EAB while meeting their own goals for the forest.

Emerald Ash Borer


Adult emerald ash borer

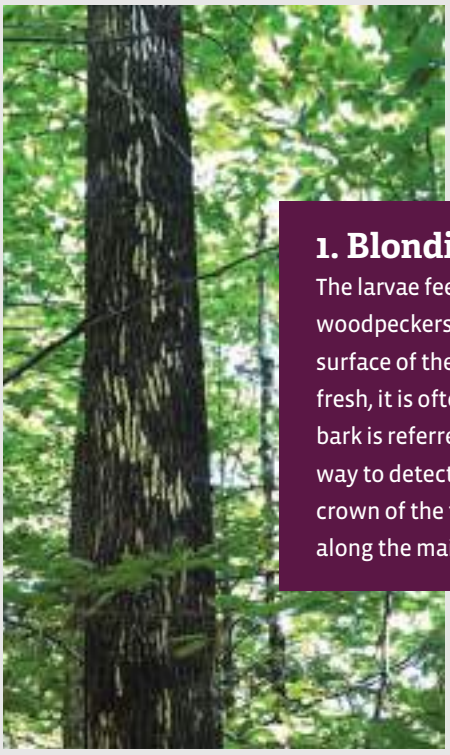
The emerald ash borer is an insect native to Asia (China, Mongolia, North Korea, South Korea, Japan, Taiwan, and the Russian Far East). It is likely that EAB traveled to the United States in wood packing material used for shipping. EAB was first detected in southeastern Michigan in 2002, although it is suspected its introduction occurred in the mid-1990s, demonstrating the critical importance of monitoring your forest in order to identify emerging forest health issues early, increasing the likelihood of successful control and eradication. The rapid spread of EAB is due, at least in part, to human movement of wood, an important reason to refrain from transporting firewood to different areas and instead buy it locally. Since its introduction, EAB has spread across the eastern United States, killing tens of millions of trees, making it the costliest insect in U.S. history. Beyond the monetary loss, ash mortality is having ecological impacts on our forests and threatening the cultural lifeways of Indigenous communities.

As an adult, EAB is a small, metallic green beetle no more than a half inch in size. In the adult stage, EAB feeds on the leaves of ash trees, causing little damage, and lays eggs in the crevices of ash bark. About a week after the eggs are laid, young EAB, which look like grubs, emerge. This is known as the larval stage of EAB development. The larvae bore under the bark, where they feed on the inner bark and phloem of the tree. As the larvae move under the bark to feed, they create S-shaped galleries that are distinctive to EAB. It is this larval stage that is so damaging to the tree, as the inner bark and phloem are the parts of the tree that transport nutrients, water, and carbohydrates (food) throughout the tree. By feeding on the inner bark and phloem, EAB disrupt the tree's ability to move these life-sustaining resources throughout the tree. The more larvae there are, the more galleries are created and the less water and carbohydrates are transported throughout the tree, ultimately leading to the tree's death. Once the larvae develop into adult insects, they chew their way through the bark in late May or early June to feed and lay eggs, starting the cycle all over again.

Beyond the monetary loss, ash mortality is having ecological impacts on our forests and the lifeways of Indigenous communities.

Without intervention, the EAB life cycle results in stress to ash trees, ultimately causing death typically in two to five years. The EAB life cycle and the ash tree's response result in several signs of EAB infestation.

Photos: (above) Nathan Siegert; (p. 5, top and bottom) Nathan Siegert; (p. 5, middle) Dave Orwig



Signs of EAB

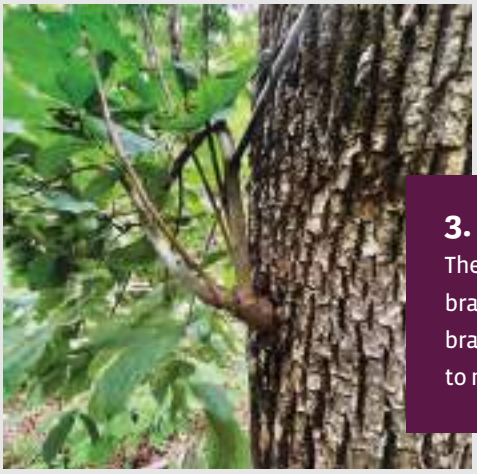
Following is a list of signs of EAB in the sequence one might expect to see them appear in a tree, with symptoms appearing in the upper canopy first, since that portion of the tree is the first one attacked by EAB.

1. Blonding of the bark.

The larvae feeding under the bark are a protein-rich source of food for woodpeckers. The excavation by woodpeckers to find the larvae removes the surface of the bark, exposing its interior. Because the interior of the bark is fresh, it is often brighter in color than the exterior bark. This stripping of the bark is referred to as "blonding" and is perhaps the easiest and most common way to detect an advanced EAB infestation. Because eggs are first laid in the crown of the tree, look for blonding at the base of the canopy on the bole and along the main branches.

2. Crown thinning and dieback.

As the tree begins to die, it is common to see the crown becoming thin and even see branches of the crown beginning to die off.



3. Epicormic branching.

The tree's response to the stress of the larvae is to put out more branches along the main stem of the tree. These epicormic branches grow from dormant buds and are an effort by the tree to maintain production of life-sustaining carbohydrates.

4. D-shaped adult emergence holes.

When the adults emerge from beneath the bark, the emergence holes are small (1/8") and D shaped. These exit holes can be seen on the main stem of the ash tree. Because eggs are first laid in the upper crown of the tree, these exit holes will not appear at eye level until later in an infestation.

5. S-shaped larval galleries.

As the larvae feed beneath the bark, they create S-shaped galleries. In the advanced stages of infestation, bark will be sloughing off the tree, which may reveal these galleries. If an ash tree falls, you can remove the bark to determine if the galleries are present.

Photos: (top) Dave Orwig, (bottom) Nathan Siegert, (p. 7) Dave Orwig

Monitoring your forest for EAB infestation is an important first step in managing your forest for the threat of EAB.

Understanding where EAB is within your region's landscape can also provide an indication of the likelihood of its presence in your woods or the possible timing of its arrival. Finding EAB before the trees are dead or in serious decline can give you more forest management options. To determine the presence of EAB near you, visit your state's Forest Health program.

See "Additional Resources" for contact information.

Goals for Managing Forests Threatened by EAB

There are important and overlapping goals to achieve by managing forests threatened by EAB. These goals can help direct the types of adaptive strategies to be implemented.

Figure 1. Goals guiding species preservation efforts in the face of non-indigenous insects and pathogens. A given goal may be the primary motivation for a preservation effort, but each goal may be supported depending on the preservation approach used (e.g., protection of a group of mature trees to maintain cultural integrity may also sustain ecological function, preserve genetic diversity, and fulfill ethical responsibility tied to stewardship). Overlapping colors in the outer circle reflect complementary relationship between goals (D'Amato et al. 2023a; D'Amato et al. 2023b).

D'Amato, Anthony W., David A. Orwig, Nathan W. Siegert, Amanda Mahaffey, Les Benedict, Tyler Everett, John Daigle, Logan Johnson, Paul Catanzaro, and Caitlin Cusack. 2023a. "Species Preservation in the Face of Novel Threats: Cultural, Ecological, and Operational Considerations for Preserving Tree Species in the Context of Non-indigenous Insects and Pathogens." *Journal of Forestry*, fvad024, https://doi.org/10.1093/jofore/fvad024.

———. 2023b. "Towards Tree Species Preservation: Protecting Ash amidst the Emerald Ash Borer Invasion in the Northeast." *Journal of Forestry*, fvad025, https://doi.org/10.1093/jofore/fvad025.

Meeting ethical responsibility.

Ethics are a set of principles or a code of conduct that guides our actions. Some believe that ethics not only apply to our relationships with other humans but also help guide our actions and relationship with the world around us. For instance, from an Indigenous perspective, the entire natural world has a responsibility to maintain the dynamic relationships among beings. This responsibility is fulfilled by honoring the gifts we offer one another as beings within the natural world. Similarly, from a Western science perspective, ethical responsibility describes preservation of species motivated by a land ethic, or an ethical obligation to conserve native species in the face of a human-induced stressor (e.g., NIIP). For foresters, professional codes of ethics also support the preservation of ash.

Maintaining cultural integrity.

Many native tree species serve as the cornerstone of Indigenous cultures and livelihoods, supporting traditions (e.g., basketmaking), cultural lifeways, spirituality, and subsistence. Black ash (also referred to as brown ash) and many other species threatened by NIIP are central to oral traditions, ceremonies, and legends, increasing the magnitude of species loss on cultural identities, with impacts far exceeding those measured by ecological or economic criteria. Preserving ash helps to maintain these essential cultural connections.

Sustaining ecological function.

Each species plays a unique role in our forests, providing benefits that we depend on. The loss of even one species from a forest weakens the connections within, which can have negative impacts on the benefits the forest provides and its overall resilience. Forest management strategies to control invasive plants ensure tree regeneration after ash mortality, maintain forest complexity, and sustain forest benefits and resilience. It may also be possible to preserve some ash species within the forest, maintaining the unique ecological functions they provide (habitat for different species, influence on nutrient and water cycles).

Preserving genetic diversity.

Trees have a high amount of genetic diversity. This genetic diversity helps them survive through the many challenges they will face in the span of their long lives. In other words, not all ash trees have the same genetics. Preserving a diversity of ash across the landscape will help maintain the genetic diversity of this species and will increase the chances that at least some ash will survive into the future through a tolerance for EAB and resilience to future conditions.

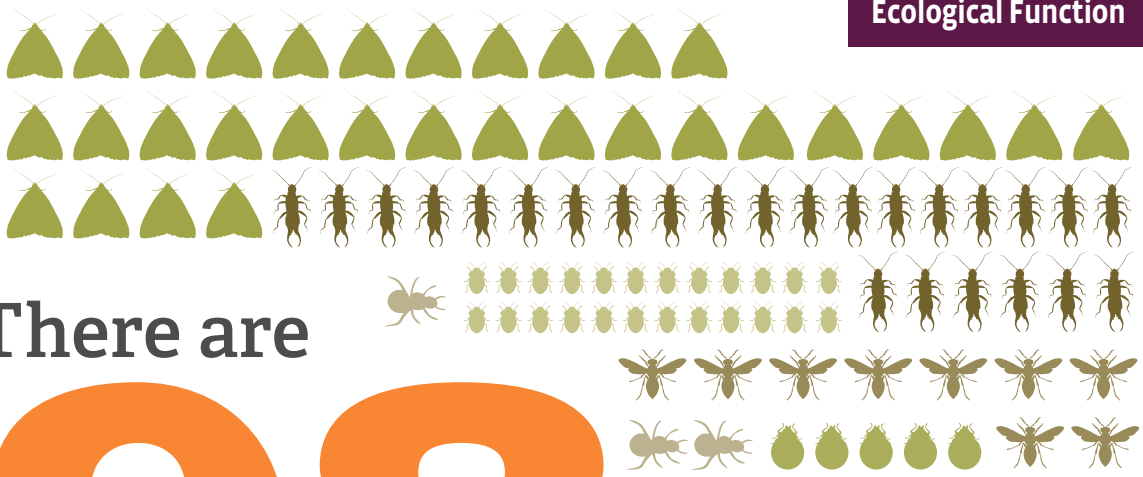
Photo: Amanda Mahaffey

Les Benedict of the Saint Regis Mohawk Tribe has been a leader in developing and sharing strategies to preserve ash.

Although a common reaction to the threat of EAB is that nothing can be done to stop its impacts, these important goals provide motivation to address the threat caused by EAB.

There are a growing number of strategies designed to promote well-adapted, vigorous future forests that include an ash component and achieve these important goals. A key element to these strategies is to make sure we are managing the forest, not the insect. Now is the time to implement these strategies, as we are at a critical juncture where opportunities exist to preserve the ash species in our forests before they are all gone.

> “Many of our traditional teachings recognize that certain species are our helpers and guides. The Original Instructions remind us that we must return the favor. It is an honor to be the guardian of another species—an honor within each person’s reach that we too often forget. A black ash basket is a gift that reminds us of the gifts of other beings, gifts we can gratefully return through advocacy and care.”
>
> Robin Wall Kimmerer
> *Braiding Sweetgrass*



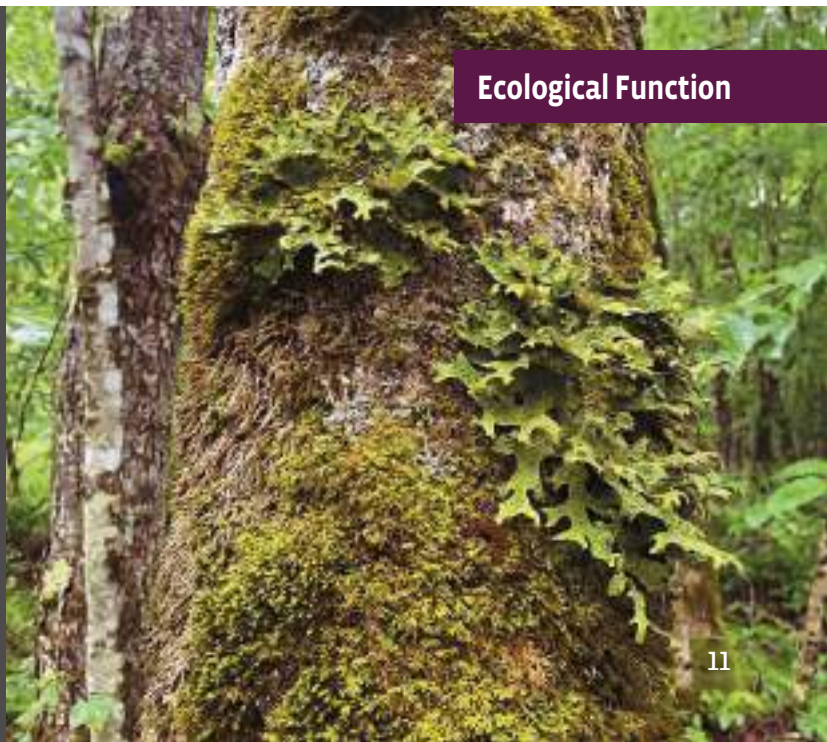
There are 98 invertebrate species that specialize in feeding on the leaves of North American ash.

About one-third of those species are moths, some of which have been designated as being high-risk species for extinction because of their dependence on ash (Wagner and Todd 2016).

By comparison, only five species of herbivores are thought to have been driven to extinction by the introduction of chestnut blight into the United States (Wagner and Van Driesche 2010).

Wagner, David L., and Katherine J. Todd. 2016. "New Ecological Assessment for the Emerald Ash Borer: A Cautionary Tale about Unvetted Host-Plant Literature." *American Entomologist* 62 (1): 26–35, https://doi.org/10.1093/ae/tmw005.
Wagner, David L., and Roy G. Van Driesche. 2010. "Threats Posed to Rare or Endangered Insects by Invasions of Nonnative Species." *Annual Review of Entomology* 55 (1): 547–68.

Fungal biodiversity plays a critical role in ecosystem function and has been greatly affected by human impact on forests (i.e., less coarse wood and large, old trees). Ash bark is less acidic than other trees, allowing it to host a wider diversity of lichens, supporting diverse fungal biota. Ash can also grow old, living for hundreds of years, and large, supporting the development of fungal biodiversity.



Ecological Function

Photos: (p. 10) Tyler Everett; (right) Nathan Siegert

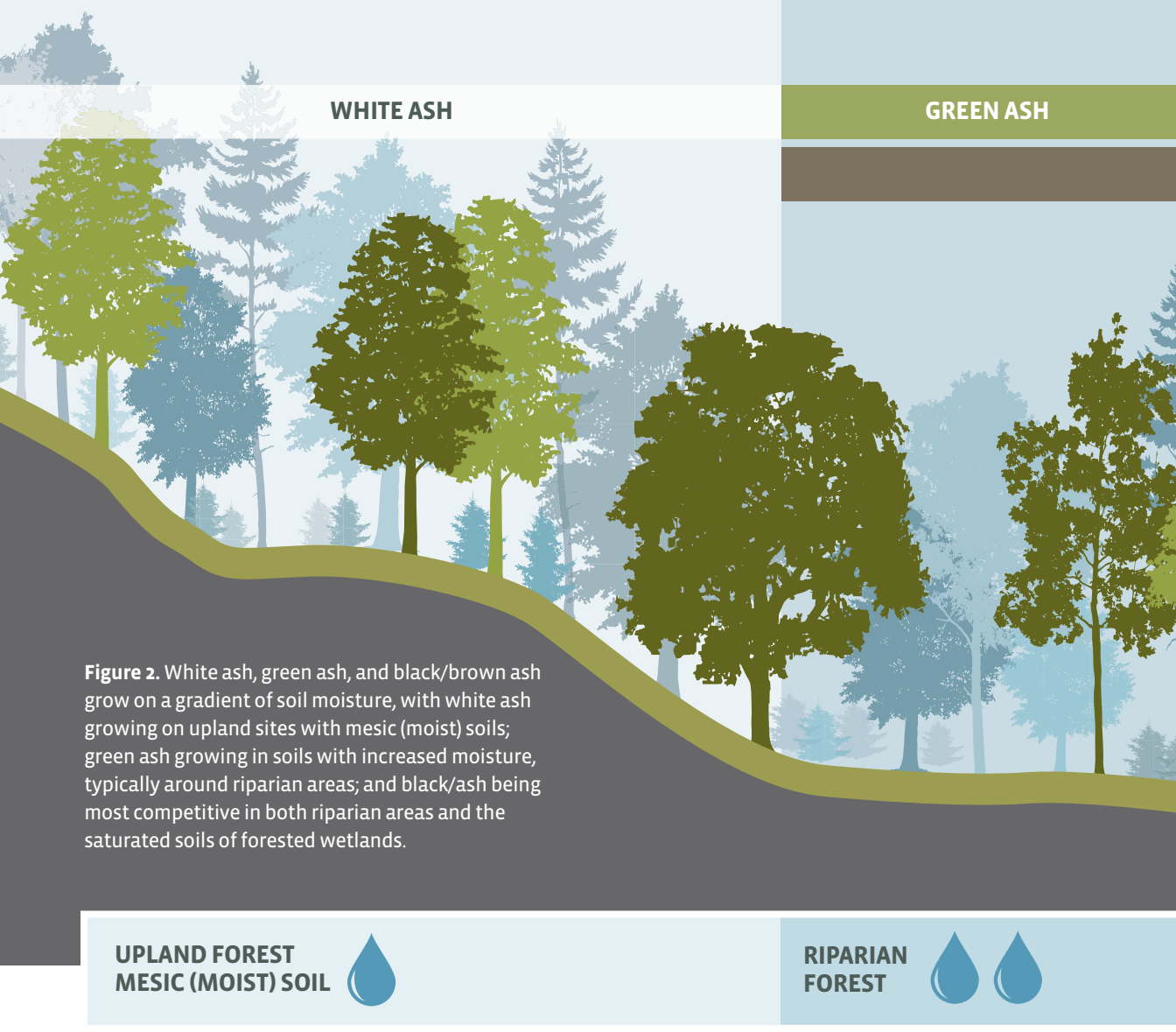
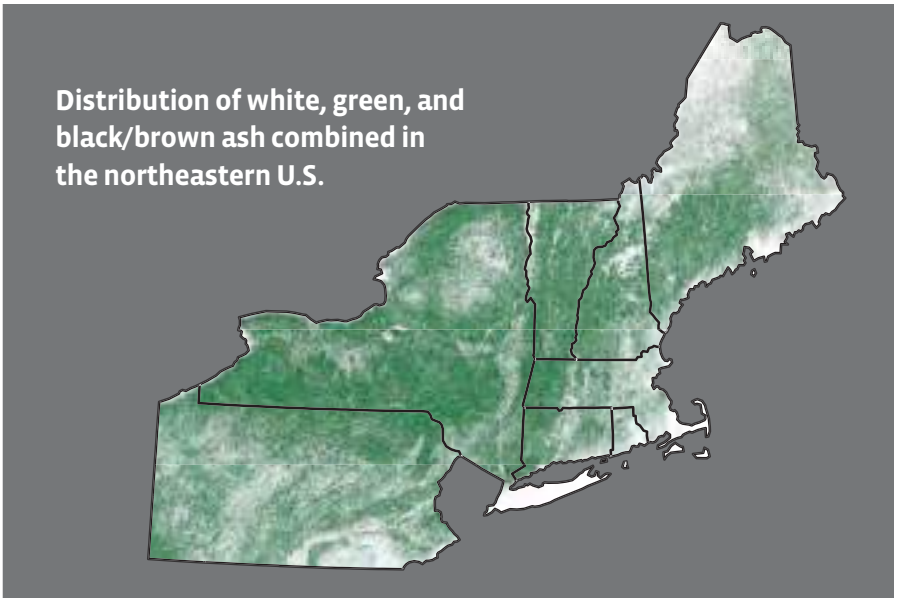
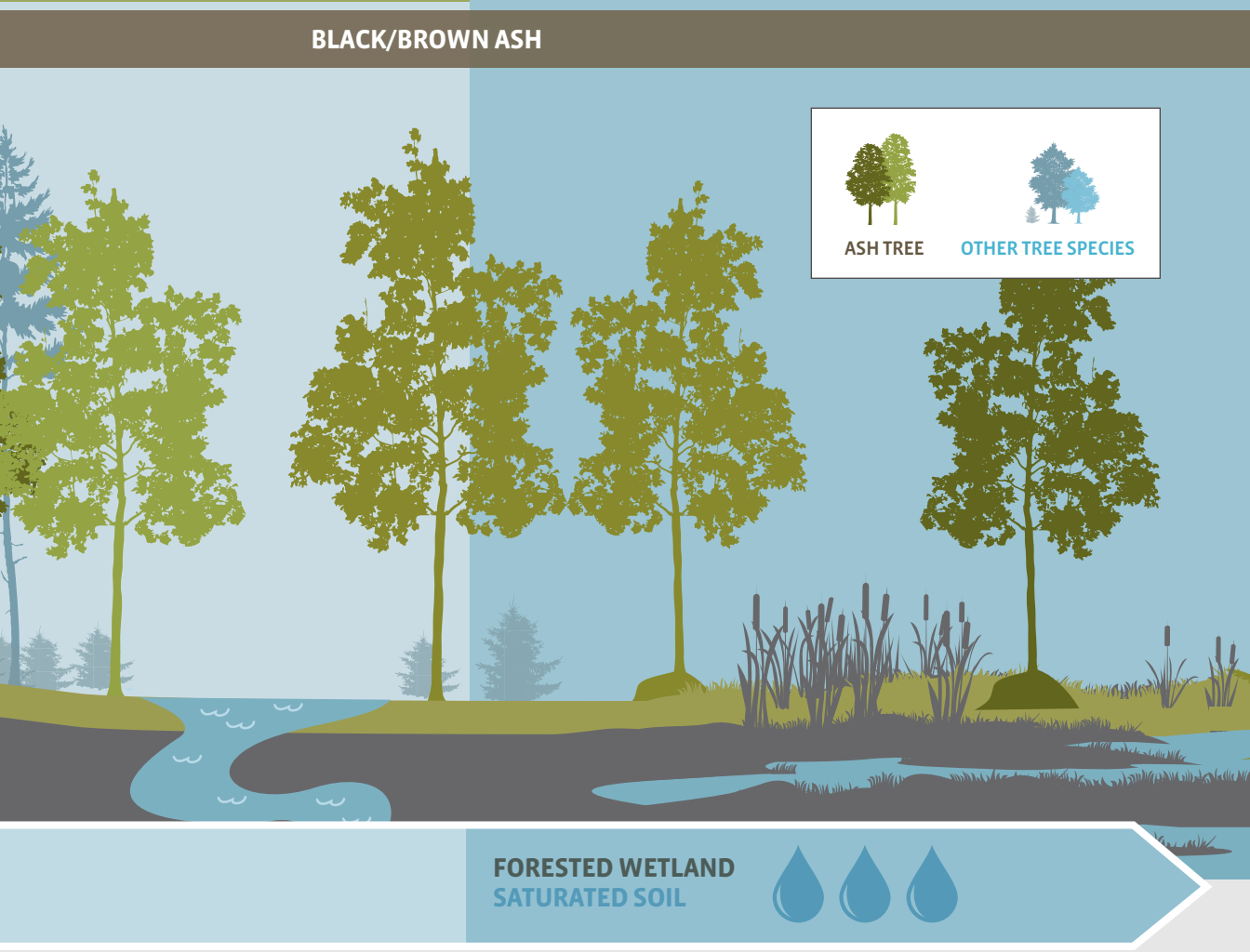


Figure 2. White ash, green ash, and black/brown ash grow on a gradient of soil moisture, with white ash growing on upland sites with mesic (moist) soils; green ash growing in soils with increased moisture, typically around riparian areas; and black/ash being most competitive in both riparian areas and the saturated soils of forested wetlands.



Map by Lina Clifford



Understanding Ash

A basic understanding of common ash species of the northeastern United States, specifically where and how they grow, will help inform the opportunities to manage forests with ash and preserve these threatened species.

There are sixteen species of ash found across the United States; however, the three main ash species in the northeastern United States are white ash, green ash, and black/brown ash (see map on p. 12), with white ash being the most common. Relative to other trees, each of the three northeastern ash species prefers growing on sites with large amounts of water and nutrients. However, there are differences between the amount of water and the number of nutrients each of these species prefer, leading to their occurrence in distinct habitats and forest types.

White ash

White ash is best suited to upland soils that are nutrient rich and contain plenty of moisture, also known as mesic sites. These types of sites are often found in areas of the landscape that collect water, nutrients, and organic matter, such as coves and the base of hills. These upland sites are numerous, helping to make white ash the most common ash species in the region. White ash rarely grows in pure stands but rather is a common component in northern hardwood forests, growing alongside sugar maple, yellow birch, American beech, hemlock, and red spruce. Generally speaking, the richer the site, the more ash will be likely to be found on it. Ash can commonly make up 5 to 25 percent of the trees in northern hardwood forests but can occasionally represent an even greater percentage on rich northern hardwood sites with high levels of nutrients.

Green ash

Green ash can tolerate more water than white ash and is often found in riparian and low-lying areas. Unlike white ash, green ash can often be the dominant species in lowland settings, particularly riparian forests, because it is well-adapted to areas with high water levels. Green ash is often found within forest types composed of other tree species well-adapted to wet conditions, such as ash-elm-maple and elm-ash-cottonwood forests.

Black/brown ash

Black/brown ash is a wetland species capable of growing on sites with water-saturated soils for at least part of the year. Like green ash, black/brown ash has unique adaptations to saturated soil conditions, which result in it often being the dominant tree species in wetlands. In these wetland ecosystems, black/brown ash is a keystone species, with a highly influential role in water levels, nutrient dynamics, and aquatic food webs. These areas also hold cultural significance for Indigenous peoples. Given the sites where black/brown ash grows, this ash species is often smaller in diameter than white or green ash.

When looking to identify ash in a forest, prioritizing this range of sites from mesic to wet will provide the greatest likelihood of success. The location of the ash will help determine specific forest management and ash preservation strategies.

See "Forest Management Strategies for Forests Threatened by EAB" on p. 16.

Beyond site preference, there are several ways to identify an ash tree.

Bark. The bark of a mature white ash has deep diamond-shaped fissures (see photo p. 15, top). Green ash shares a similar diamond-shaped bark pattern, but the fissures are less prominent. The bark of black/brown ash looks rough and corky.

Leaves. Ash leaves are compound, meaning that each leaf has between five and nine leaflets connected to a central stalk (see photo p. 15, middle).

Branching pattern. Ash can also be identified by its branching pattern, which is known as opposite (see photo p. 15, bottom). A tree with an opposite branching pattern has branches that grow completely opposite of each other. Since ash branches are relatively thick, they have a strongly opposite appearance. The other common tree species in the Northeast with opposite branching is maple; however, maple trees have a single leaf and gray bark without fissures.

Growing site. Once a tree has been identified as an ash, the location it is growing in is often the best indicator of the specific species (see figure 2, pp. 12–13). There are also tree identification apps that can be used to identify ash and differentiate among the species.

Contacting a forester is also an option to better identify ash in your forest (see "Find a Forester" under "Additional Resources").

White ash bark with diamond-shaped fissures

Compound white ash leaf with 7 leaflets

White ash branches demonstrating their strongly opposite appearance

Ash is dioecious (di-ee-shus), meaning that there are male and female ash trees. Like all sexual reproduction, ash requires both male and female individuals to create a fertilized flower, which will result in a seed. An ash tree typically needs to be about 8"–10" diameter at breast height (4' 6" from the ground), or approximately twenty years old before it flowers. Ash is wind pollinated and seed is wind dispersed, traveling upwards of 450 feet from the parent tree. Ash seeds germinate best in partial shade; about half shade, half sun is optimal.

As a seedling, ash is shade tolerant, which allows it to exist in almost full shade and grow slowly in the partial shade of the understory. However, the older ash gets, the more sun it needs. As a sapling and mature tree, ash is classified as shade intolerant (i.e., needing full sun). This change in shade tolerance means that ash can exist in the shade of the understory but eventually needs sunlight from a gap in the canopy to grow and survive. This shift is an important consideration that influences forest management strategies. For example, in upland forests, white ash is considered a large-gap-obligate species due to the larger canopy openings it needs to become a mature tree relative to other species it grows with, like sugar maple and beech. In addition to regenerating from seed like all hardwoods, ash can also sprout from seedlings, saplings, and mature trees that have been cut.

Ash has evolved for thousands of years, developing these competitive strategies to sustain itself in the forests of the northeastern United States. Understanding these characteristics provides important insights into forest management strategies for forests threatened by EAB.

Photos: (top, middle) Nathan Siegert; (bottom) ®Frank Bramley/Native Plant Trust

Forest Management Strategies for Forests Threatened by EAB

There are a number of forest management and ash preservation strategies. The sites on which northeastern ash species grow provide a framework for the application of these strategies, as not all strategies are appropriate on all sites. Despite the need to address the threats of EAB, it is important to safeguard all the benefits a forest provides, including water quality. The silvicultural strategies to facilitate forests moving through the impacts of EAB are meant to be applied in upland forests and are therefore primarily directed at sites growing white ash. Applying these silvicultural strategies in riparian and wetland forests is likely not appropriate and may be counter to state or municipal policies, such as forestry best management practices, wetlands protection regulations, and forest cutting practices legislation.

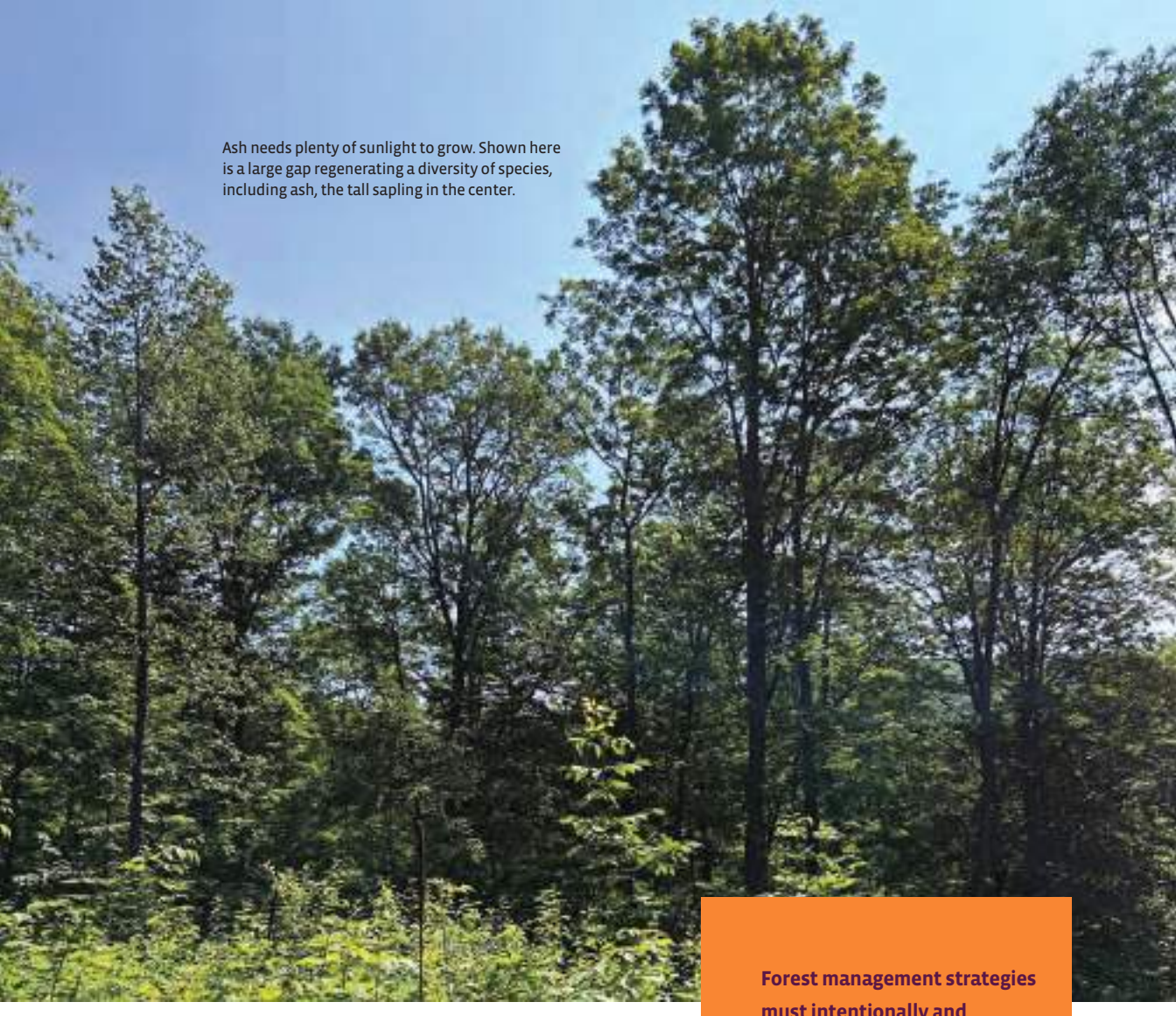
On the other hand, the preservation strategies discussed here can likely be applied across all ash species growing across all sites. In fact, the successful preservation of ash will necessitate applying these strategies to different species and sites in order to preserve a diversity of trees and genetic material.

Silvicultural strategies in upland forests with white ash

Forest management to address the threats of EAB must be done in consideration of the whole forest, not just ash. In other words, manage the forest, not the insect. While timber harvests that focus primarily on the removal of dead and dying ash recover the economic value of these trees, these harvests don't address the long-term well-being of the forest. Management strategies must intentionally and purposefully strive to create desirable future forest conditions to promote well-adapted, diverse forests. Following are recommended strategies to achieve these goals through active forest management.

Ensure timely and sufficient regeneration.

Regeneration is essential to the future of your forest. Management activities should focus on creating the conditions that favor species adapted to the ecological conditions of your property. Choose species well-suited to the soil of the site, and create favorable light conditions. Some of the species commonly growing with ash in northern hardwood forests, like sugar maple, are tolerant of shade, often exist as seedlings in the understory, and may need only small canopy openings to regenerate. In contrast, white ash, although shade tolerant as a seedling, requires openings of at least one-quarter to one-third acre in size to develop in the canopy. As a result, if your goal includes regenerating ash, using silvicultural strategies like group selection to create the larger openings ash needs is important. Similarly, techniques like shelterwood harvests, which distribute partial shade across a forest, can be effective if residual basal area targets are 30 to 60 square feet per acre, or 40 to 60 percent canopy cover.



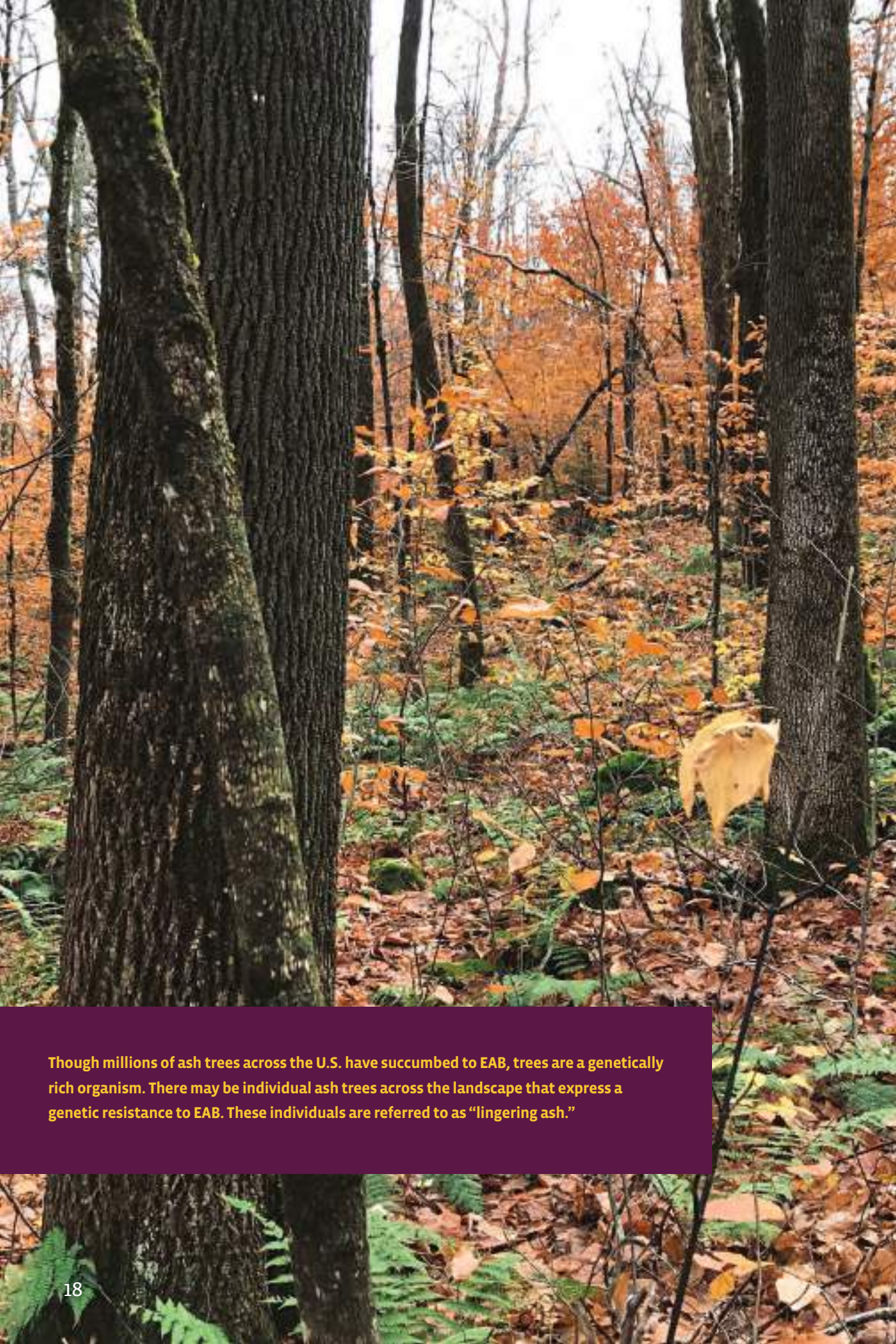
Ash needs plenty of sunlight to grow. Shown here is a large gap regenerating a diversity of species, including ash, the tall sapling in the center.

Forest management strategies must intentionally and purposefully strive to create desirable future forest conditions to promote well-adapted, diverse forests.

Control invasive plants. Ash is not the only species that prefers to grow on mesic sites (those with high soil moisture and nutrients). A number of invasive, exotic (I/E) plants also prefer mesic sites (e.g., Japanese barberry and Oriental bittersweet). This means that managing forests with ash must also include efforts to identify and control I/E plants. Forest management without the control of I/E plants may only serve to create the light conditions that allow these plants to spread. A pre-harvest inventory of I/E plants is the first step. If any I/E plants are found on the site, a plan should be put into place to eradicate them before harvesting begins. It is also recommended that before bringing machines onto the site, all machinery should be power-washed to prevent the spread of seeds from one site to another.

Address deer herbivory. Deer herbivory should also be evaluated to help ensure regeneration success. Ash is preferred browse, partly because it grows fast and is often one of the tallest trees growing in a gap, making it an easy target for browse. If deer browse levels are high, consider ways to control local deer populations (through hunting) and to protect regeneration in gaps (tree shelters, sapling cones, deer fencing, slash walls).

Photo: Anthony D'Amato



Though millions of ash trees across the U.S. have succumbed to EAB, trees are a genetically rich organism. There may be individual ash trees across the landscape that express a genetic resistance to EAB. These individuals are referred to as "lingering ash."

Retain a diversity of ages, including mature ash. The type and number of trees left on a site are just as important as—or even more important than—the trees removed. Retain a diversity of tree ages, from young to ecologically mature. Young trees provide a new generation of ash in the landscape. Ecologically mature trees are an important component of our forests that are threatened by EAB, so deliberately retaining mature trees is an important way to ensure that large tree functions are sustained into the future. This includes not only leaving legacy trees representing diverse species in areas where you are encouraging regeneration but also applying treatments to increase the vigor of canopy trees by thinning around them, thus releasing their canopies and focusing more of the limited resources of the site on these trees. Make sure to enlarge gap sizes if you retain trees within them to provide sunlight necessary to seedlings. Retaining trees with cavities or defects is an effective way to ensure a continuity of mature tree characteristics in your forest. Unless treated with systemic insecticides (see p. 24), these ash trees are likely to become infected with EAB and die, limiting their value as seed producers.

Retain male and female ash trees. Prioritize the retention of sexually mature male and female ash trees to help regenerate this species and maintain ash as a component of your property and the landscape. Females (those with seeds) are best identified by their flowers in early spring as leaves are emerging, as well as in late summer during good seed years, but remember that females will not produce seeds every year, so it may take multiple years to identify all the females. Retaining ash can include sexually mature ash in areas you are harvesting to increase the amount of ash seed rain in those places. Since ash is wind pollinated, maintaining mature male ash trees in the landscape will ensure that adequate pollen is available for producing new seeds.

A large gap providing enough sunlight to encourage ash regeneration

Intentionally passive approach in upland forests with white ash

There may be those who are interested in taking a passive approach to addressing EAB as a way of reaching their overall forest goals. If you adopt the passive approach, it is likely that if/when the EAB moves onto your property, the ash will succumb to EAB, increasing the amount of deadwood within your forest. Deadwood, especially big dead standing trees (snags) and downed logs, is an important component often lacking in many northeastern forests. Because ash can live long and grow to a large size, dead ash can help address this need.

Since ash grows with many other species, when it does succumb to EAB, the gap that is created is often the size of a single canopy tree. The amount of sunlight from a single canopy tree is typically too small to reproduce ash, since ash needs large gaps with abundant sunlight. As a result, as ash trees die, the gap left in the forest is often filled by existing advance regeneration and trees that can tolerate lower light levels (e.g., sugar maple and American beech). These

Photos: (p. 18 and above) Dave Orwig

tendencies can result in a forest that has reduced species diversity, fewer species predicted to compete well in future conditions, and an absence of options for future ash.

Taking a passive approach to timber harvesting doesn't have to mean no forest management. Be aware that if there are I/E plants in the understory around dying ash, they will likely take advantage of the increased sun and spread into the gaps created by the dying ash. Once occupying the gap, I/E plants often outcompete native plants and trees, making it difficult to regenerate the future forest, possibly reducing the benefits the forest provides and making it vulnerable to future disturbances. Likewise, be sure to evaluate the forest to determine the amount of deer herbivory. High amounts of deer herbivory will make regenerating new trees difficult and can lead to the establishment or spread of I/E plants, as deer preferentially browse on native plants. If you choose not to intervene in response to EAB through active forest management, consider taking an active approach to controlling invasive plant species and deer populations to help maintain the forest's ability to regenerate and develop naturally.

A flooded riparian area supporting both green and black/brown ash

While the passive approach allows the forest to develop on its own, which is appealing to a segment of landowners, the active approach may provide more opportunity to ensure that the forest regenerates—and regenerates with desirable, diverse species. In short, adopting the passive approach means accepting the results of this approach. Since our forests have been and continue to be heavily influenced by humans, it may no longer be the case that your forest will grow and develop in a way that will reach the goal you desire. Assessing the trajectory of your forest with a forester and the likely outcomes of your action/nonaction can help you make an informed decision.

Preserving white ash in upland forests and green and black/brown ash in riparian and wetland forests

While active forest management and control of I/E plants and deer are all efforts that help the forest move through EAB—increasing the likelihood of a well-adapted, diverse forest—there are preservation strategies that can be taken to help sustain ash within your forest, along with its many benefits.

Know what you have to protect (or lose). Identify ash in your forest and monitor it for signs of EAB. Alternatively, you can contact a forester for assistance in identifying ash or even conducting a full inventory of your forest.

Photos: (p. 20) Nathan Siegert; (p. 21) Anthony D'Amato

Preservation patches are likely to succumb to EAB without insecticide treatment. Treating preservation patches with insecticide will maximize the value of these patches for preserving ash.

Identify lingering ash trees. Though millions of ash trees across the United States have succumbed to EAB, trees are a genetically rich organism. There may be individual ash trees across the landscape that express a genetic resistance to EAB. These individuals are referred to as "lingering ash." Identify ash trees that have survived a wave of EAB infestation. Identifying and encouraging the regeneration of these lingering ash, including through seed collection efforts (see p. 23), may help provide a long-term solution to maintaining ash in our forests.

Lingering ash may be genetically resistant to EAB.

Female white ash tree identified for preservation strategies.

Identify female ash trees. Once you have learned to identify ash trees, it's important to determine which individuals are females. Only females produce seeds, and female ash trees will only produce seeds once every three to five years. It is believed that females make up a relatively low amount of the ash population, perhaps even less than 20 percent. Ash seeds can of course be found in the canopy of the tree and in the area around its base. Binoculars are very helpful in spotting seeds in the canopy. Once you have identified an ash tree, mark it with flagging or paint. Female ash trees can also be mapped using GPS. Late summer and early fall are ideal times to look for seeds. Once again, a forester can be of assistance (see "Find a Forester" under "Additional Resources").

Photos: (p. 22) Anthony D'Amato; (p. 23) Pieter van Loon

Collecting seeds is one way to preserve options for future generations of ash on your land and elsewhere. There are many different groups collecting seeds to preserve ash, so try to coordinate with local and national seed collection efforts to avoid duplication of these efforts and to get guidance on seed processing and storage. Trees selected for seed collection should have desirable traits, including good form, suitable qualities for basketmaking, or demonstrated resistance to EAB. Seeds should be collected in September and October, when the seeds are mature and still on the tree. There are published guides on how best to collect seeds and process them. See “Additional Resources” for information about ash seed collection.

Female ash tree in flower

Identify preservation patches. Identify groups of twelve to fifteen ash trees within 1 to 3 acres of forest as "preservation patches." Establishing preservation patches will increase pollination between trees and create a concentrated seed bank. The preservation patches should include a variety of diameters at breast height, ranging from 12 to 30+ inches, and ideally be located on sites that ash prefer. Select trees with high vigor and full crowns in a dominant or co-dominant crown position in the main canopy of the forest. Also, be sure to include a minimum of 60 to 75 percent females within the group. If you are interested in promoting multiple preservation patches in your forest, it's likely that fewer patches with more trees is better than more patches with fewer trees.

Treat preservation patches with insecticide. Preservation patches are likely to succumb to EAB without insecticide treatment. Since treating all ash trees with insecticide is cost-prohibitive, treating preservation patches will maximize the value of these patches for preserving ash. Once you have identified a preservation patch, work with a forester, a certified arborist, or someone with a valid pesticide applicator license to apply direct stem injections of emamectin benzoate, following the manufacturer's recommendations, before the tree loses 50 percent of its crown. Treatments are weather dependent and should occur between May and July. These treatments are effective for up to four years, so make sure to schedule follow-up applications accordingly.

Note: You do not have to protect all ash trees in these patches, as trees in proximity of trees treated with insecticide have also shown limited impacts from EAB.

Work at the landscape scale. Preserving ash will necessitate action on individual properties over whole landscapes. Reach out to others within your landscape area—including neighboring landowners, public land managers, and conservation organizations—to communicate the efforts you're undertaking and encourage them to adopt ash forest management and preservation strategies that meet their goals, time, and resources. Share your information and experience about the practices that work, the costs of your efforts, and details about implementation.

Seek out Indigenous partnerships. Indigenous communities have been particularly focused on maintaining ash because of the importance of ash to their cultures. The efforts of Indigenous peoples and other organizations have provided inspiration and a road map to applying strategies to sustain ash for future generations. Whether this goal is achieved through an exploration of the genetic resistance of ash to EAB, the successful biocontrol of emerald ash borer, or some combination of the two, it will be beneficial to seek out and develop partnerships with Indigenous peoples throughout the process.

Applying a stem injection of emamectin benzoate between May and July every four years can preserve an ash tree.

While each ash species has ecological value, black/brown ash also has great cultural value to Indigenous communities, meaning that preservation efforts must include not only preserving the tree species itself but also protecting the cultural lifeways that tightly weave the tree to the identities of many Indigenous peoples who have maintained a relationship with it since time immemorial.

Preserving and honoring black/brown ash: acknowledgment and access

Acknowledging and honoring black/brown ash is more important than ever, as EAB threatens its future. While each ash species has ecological value, black/brown ash also has great cultural value to Indigenous communities, meaning that preservation efforts must include not only preserving the tree species itself but also protecting the cultural lifeways that tightly weave the tree to the identities of many Indigenous peoples who have maintained a relationship with it since time immemorial. This can be done by providing access to harvest black/brown trees for traditional uses, such as pounding black/brown ash into splints for use in basketmaking. The splints can be stored for future generations to use if living ash trees are gone from an area, helping to sustain Indigenous traditions and ways of life. While access to black/brown ash trees can be given through informal permission, access can also be formalized through the use of cultural use agreements, which provide formal permission for local tribal artisans and ash harvesters to access these trees. More information about cultural use agreements can be found in the "Additional Resources" section. Cultural use agreements help start a conversation about giving tribal citizens the ability to reestablish relationships with ash trees on lands they have not had access to following colonization. Considering land return to a sovereign tribal nation would allow that community to fully control and explore reestablishing their relationship with the land on their own terms.

More information on land return efforts can be found in the "Additional Resources" section.

Applying a combination of strategies across ash species and forests

One need not choose between these strategies of forest management and ash preservation. They are, in fact, complementary approaches. Depending on one's goals, resources, forest characteristics, and landscape context, it is possible to apply a combination of strategies across a property or properties to meet landowner goals. Determine your goals for the forest, understand the characteristics of your forest (i.e., the number and location of ash species, other species in the forest, the presence of invasive exotic species, and deer herbivory levels), assess the EAB threat, and choose strategies to match these factors. A forester can also help you define your goals and gather the information necessary to make an informed decision.

See "Find a Forester" under "Additional Resources."

Conclusion

NIIP, including EAB, are having a profound impact on the forests of the Northeast. Sometimes the worst part of facing a challenge is feeling helpless or overwhelmed. The arrival of EAB is inevitable and likely out of your control; however, your reaction to its arrival is within your control.

It's not too late, so don't give up.

Be proactive while there is still ash and opportunities to sustain it. You play a critical role in saving a species and helping to maintain the fabric of our forests. The choice is yours!

Photo: Dave Orwig

Additional Resources

Find a Forester

State service forester. An employee of the state natural resource agency, a service forester can provide free technical assistance and education, helping landowners understand their forest and programs that may be able to assist them in reaching their goals. State service foresters typically do not implement forest management practices in the field.

Consulting forester. A private forester works directly for a forest landowner. Consulting foresters are paid to conduct inventories, write forest management plans, set up timber harvests, map forest resources, control I/E plants, address forest health issues, and perform other on-the-ground forest management services.

Connecticut

STATE SERVICE FORESTER:
portal.ct.gov/DEEP/Forestry/Service-Forestry-in-CT

CONSULTING FORESTER:
ctforestry.cahnr.uconn.edu/find-a-forester/

Maine

STATE SERVICE FORESTER:
maine.gov/dacf/mfs/policy_management/district_foresters.html

CONSULTING FORESTER:
maine.gov/dacf/mfs/policy_management/selecting_a_consulting_forester.html

Massachusetts

STATE SERVICE FORESTER:
masswoods.org/professionals

CONSULTING FORESTER:
masswoods.org/professionals

New Hampshire

STATE SERVICE FORESTER:
extension.unh.edu/countyforesters

CONSULTING FORESTER:
extension.unh.edu/resource/directory-licensed-foresters

New York

STATE SERVICE FORESTER:
dec.ny.gov/lands/97398.html

CONSULTING FORESTER:
dec.ny.gov/lands/5230.html

Pennsylvania

STATE SERVICE FORESTER:
dcnr.pa.gov/Conservation/ForestsAndTrees/ManagingYourWoods/Pages/default.aspx

CONSULTING FORESTER:
dcnr.pa.gov/Conservation/ForestsAndTrees/ManagingYourWoods/Pages/default.aspx

Rhode Island

STATE SERVICE FORESTER:
dem.ri.gov/programs/forestry/stewardship/index.php

CONSULTING FORESTER:
dem.ri.gov/programs/forestry/stewardship/index.php

Vermont

STATE SERVICE FORESTER:
fpr.vermont.gov/forest/list-vermont-county-foresters

CONSULTING FORESTER:
fpr.vermont.gov/forest/managing-your-woodlands/working-professional

Forest Health Programs

Connecticut Department of Energy and Environmental Protection—Forest Health and Climate Change:
portal.ct.gov/DEEP/Forestry/Forest-Health-and-Climate-Change

Maine Forest Service—Forest Health and Monitoring:
maine.gov/dacf/mfs/forest_health/

Massachusetts Department of Conservation and Recreation—Forest Health Program:
mass.gov/service-details/forest-health-program

New Hampshire Division of Forests and Lands—Forest Health:
nh.gov/nhdfl/community/forest-health/index.html

New York Department of Environmental Conservation—Forest Health:
dec.ny.gov/lands/4969.html

Pennsylvania Department of Conservation and Natural Resources—Forest Insects and Diseases:
dcnr.pa.gov/Conservation/ForestsAndTrees/InsectsAndDiseases/pages/default.aspx

Rhode Island Department of Environmental Management—Forest Health Program:
dem.ri.gov/natural-resources-bureau/agriculture-and-forest-environment/forest-environment/forest-health

Vermont Department of Forests, Parks, and Recreation—Forest Health:
fpr.vermont.gov/forest/forest-health

Additional EAB Resources

Insecticide Options for Protecting Ash Trees from Emerald Ash Borer, 3rd ed.
Daniel A. Herms, Deborah G. McCullough, David R. Smitley, Clifford S. Sadof, Frederick D. Miller, and Whitney Cranshaw (2019)
emeraldashborer.info/documents/multistate_eab_insecticide_fact_sheet.pdf

Ten Recommendations for Managing Ash in the Face of Emerald Ash Borer and Climate Change
Anthony D'Amato, Amanda Mahaffey, Leonora Pepper, Alexandra Kosiba, Nancy Patch, and Pieter van Loon (2020)
foreststewardsguild.org/wp-content/uploads/2020/07/Ten-Recommendations-for-Managing-Ash.pdf

EAB Response: An Ash Resource Inventory Field Manual
Tyler D. Everett (2019)
maine.gov/dacf/mfs/forest_health/invasive_threats/eab/documents/Ash_Resource_Inventory_Field_Manual_Everett.pdf

*Methods for Collecting Ash (*Fraxinus *spp.) Seeds*
Kathleen S. Knight, Robert P. Karrfalt, and Mary E. Mason (2009)
fs.usda.gov/nsl/gtr_nrs55_AshSeedCollection.pdf

Resources for Indigenous Partnerships

Ash Protection Collaboration across Wabanakik
umaine.edu/apcaw/

Cultural Use Agreements
firstlightlearningjourney.net/resources/cultural-easements-and-culture-use-agreements/

Land Return Resources: Wabanaki Self-Determination Fund
firstlightlearningjourney.net/working-groups/fund/

Our decisions will be the difference as to whether our ash species disappear from our landscapes forever or remain a part of our northeastern forests for generations to come, continuing to provide their unique ecological and cultural benefits.

Richard Silliboy

Vice chief, Mi'kmaq Nation, and master basketmaker

Photo: Tyler Everett