Developing a Community Emerald Ash Borer Action Plan

Perserving Urban Forests for the Future
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I. Summary

According to the USDA Forest Service and the Tennessee Department of Agriculture Division of Forestry (TDF), an estimated 271 million ash trees in Tennessee, amounting to $11 billion value, could potentially become infested with the emerald ash borer. Emerald ash borer (EAB), *Agrilus planipennis*, attacks only ash trees. It is believed to have been introduced into Michigan in the late 1990s on wood packing material from Asia. Since then, the destructive insect has been found in numerous states including Tennessee. Typically, the emerald ash borer beetles can kill an ash tree within three years of the initial infestation.

A Community EAB Action Plan is essential in order to address the impacts of EAB on a community, identify mitigation strategies, organize outreach, and preserve urban forestry management goals. EAB will cost every community due to loss of ecosystem services provided by ash trees, risks associated with ash mortality, accumulating requisite tree removals (financial and resource drain), and chemical treatment costs to preserve high value ash trees. Being proactive is essential in order to reduce costs, defer management over a long time period (thereby making goals accomplishable), and to maximize options available to a community. As EAB infestation progresses in a community, management options decrease, costs increase. Every community should identify their risk tolerance based on the information provided in this binder.

The central tenant to this binder is outreach and while it is in itself a separate section, it should be present throughout the development and implementation of a Community EAB Action Plan. However under each section are informative documents to help develop the core elements of a Community EAB Action Plan. Additional links have also been listed to provide further resources for plan development.

While the wave of EAB inflicted ash mortality has and will continue to leave a permanent mark on the communities of Tennessee, there are also many opportunities during the development and implementation of a Community EAB Action Plan to channel community momentum to further urban forest initiatives. This may include the expansion of an EAB-killed tree replacement program into a comprehensive urban tree plan; or the development of wood utilization networks to process urban wood following the flux from EAB mortality. The Tennessee Division of Forestry has several services to assist communities in these regards including tree planting grants and high quality seedlings from the state nursery. It is our goal to increase the value of our rural and urban forests in Tennessee and protect them from damaging agents, such as EAB.

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II. Background

The Tennessee Division of Forestry

The Tennessee Division of Forestry promotes the wise use of forest resources by providing technical assistance to landowners, fighting wildfires, providing quality tree seedlings, monitoring insects and diseases, improving urban forests, managing state forests, protecting water quality and collecting forest inventory data. The Division of Forestry protects Tennessee's forests by monitoring insect pests, providing information to the public and taking action to control or slow the spread of certain forest pests such as gypsy moth, Asian longhorned beetle, and the emerald ash borer.

Within the Tennessee Division of Forestry, the Forest Health and Sustainability Unit seeks to minimize both urban and rural forest loss from a variety of stressors. Not limited to just insects and disease, forest health is influenced by abiotic events, invasive plants, air and water quality, soil compaction, wildfire and much more. Maintaining forest health as the guiding principle allows the Unit to develop a more holistic, sustainable approach to all forest management thus demonstrating the connectivity of forest health to the human interface and ecosystem services.

Additional Resources
http://www.tn.gov/agriculture/topic/ag-forests-seedlings
http://protecttnforests.org/
https://www.tn.gov/agriculture/topic/ag-eac-forestry
https://www.tn.gov/agriculture/section/forests
Identification

Ash Tree

EAB attacks all four species of ash in Tennessee including: green ash (*Fraxinus pennsylvanica*), white ash (*Fraxinus americana*), black *Fraxinus nigra*), blue ash (*Fraxinus quadrangulata*), pumpkin ash (*Fraxinus profunda*). White fringe tree (*Chionanthus virginicus*) is also attacked.

An ash tree is most easily identified by: 1) **opposite branching pattern, buds, and leaf scars** (two branches come off the main stem, one on each side and directly opposite each other) 2) **compound leaves** with 5-11 leaflets (depending on the species of ash). Leaflets are moderately toothed and may be stalked or sessile 3) **many small dots (vascular bundles) on leaf scars**, and 4) **thick, diamond-patterned bark** (Cited [here](https://datcpservices.wisconsin.gov/eab/article.jsp?topicid=17))

**Additional Resources**

* [http://vanderbilt.edu/trees/pages/ash](http://vanderbilt.edu/trees/pages/ash)
* [http://dendro.cnre.vt.edu/dendrology/factsheets.cfm](http://dendro.cnre.vt.edu/dendrology/factsheets.cfm)
Emerald Ash Borer

The adult emerald ash borer (EAB), *Agrilus planipennis* is about 1/2 inch long, 1/8 inch wide, and are bronze, golden, or reddish green with darker metallic green wings. The underside is metallic purple-red. The adults can usually be seen from June to August. The larvae are 1 to 1.2 inches long and are white or cream colored. The larvae make S shaped galleries under the bark of the ash tree. The larvae and galleries can usually be seen year-round. Once the tree is infested and the emerald ash borer population builds, the leaves begin to wilt and branches die leaving a sparse canopy. D shaped holes, which are 1/8 inch in wide which can be seen year-round, may be noticeable in the branch and trunk where the adult beetles emerged. Early detection is very difficult as it takes 1-3 years of infestation before an ash tree begins to show signs of mortality or decline. Tree mortality is caused when larvae feed on the tissue between the sapwood and the bark thus disrupting the transportation of nutrients and water. This disruption eventually causes the branches to die first followed by the entire tree.

Additional Resources

- [http://bugwood.org/](http://bugwood.org/)
The Spread of Emerald Ash Borer

Emerald ash borer is an exotic beetle that was discovered in southeastern Michigan near Detroit in the summer of 2002. The adult beetles nibble on ash foliage but cause little damage. The larvae (the immature stage) feed on the inner bark of ash trees, disrupting the tree's ability to transport water and nutrients. Emerald ash borer probably arrived in the United States on solid wood packing material carried in cargo ships or airplanes originating in its native Asia. Since its discovery; EAB has killed hundreds of millions of ash trees in North America; caused regulatory agencies and the USDA to enforce quarantines and fines to prevent potentially infested ash trees, logs or hardwood firewood from moving out of areas where EAB occurs; and cost municipalities, property owners, nursery operators and forest products industries hundreds of millions of dollars. (Above cited from http://emeraldashborer.info/)

Since its discovery in Tennessee at a truck stop on I-40 in Knox County in July 2010, EAB has spread rapidly throughout the state. By 2011 six Tennessee counties, Blount, Claiborne, Grainger, Knox, Loudon, and Sevier were under emerald ash borer quarantine. In 2012, 12 more counties were added to the original 6: Anderson, Campbell, Cocke, Greene, Hamblen, Hancock, Hawkins, Jefferson, Monroe, Roane, Smith, and Union. In 2013, 3 additional counties were added: Hamilton, Jackson and Scott. In 2014,18 new counties were added including Davidson, Fentress, McMinn, Morgan, Polk, Putnam, Rhea, Sullivan, and Washington where EAB was positively detected; and Bradley, Carter, Clay, Johnson, Macon, Meigs, Overton, Pickett, and Unicoi where EAB was likely present based on close proximity to positive counties. By October 2015, eight (8) new counties were added and included Bledsoe, Cumberland, Franklin, Marshall, Rutherford, Trousdale, Williamson and Wilson. As of July 2016, twelve additional counties – Marion, White, Lincoln, Moore, Bedford, Coffee, Grundy, Cannon, Warren, Sequatchie, Van Buren, and De Kalb- have been added to the quarantine. As of spring 2017, the total number of counties quarantined for EAB to 59.

Additional Resources
http://www.tn.gov/assets/entities/agriculture/attachments/AgBusEab_map.pdf
http://emeraldashborer.info/documents/MultiState_EABpos.pdf
Monitoring

USDA Animal and Plant Health Inspection Service (USDA APHIS), along with the aid of the Tennessee Department of Agriculture organizes emerald ash borer trapping activities each year. These traps are large, purple triangular traps that resemble a box kite and are hung in ash trees throughout Tennessee. In 2016 approximately 1,500 purple traps were placed across the state of Tennessee. Monitoring traps are only placed in non-quarantined counties.

Regulation

In order to slow the spread of EAB the USDA APHIS has instituted a federal quarantine of EAB infested counties. A state level quarantine that is instituted by the Tennessee Department of Agriculture Consumer & Industry Services (TDA C&IS) is also enforced. As such there are federal and state laws in place regulating the movement of ash plants and plant material (firewood, pallets, etc.) from inside a quarantined area to outside a quarantined area. This does not regulate the movement of infested material within the quarantined area. However movement of infested material will only increase the impacts of EAB. Movement of firewood is strongly linked to a host of pest diseases and insects which negatively impacts the health of Tennessee forests.

Additional Resources

https://www.tn.gov/assets/entities/agriculture/attachments/0080-06-10.20110228.pdf
https://www.aphis.usda.gov/aphis/ourfocus/planthealth/plant-pest-and-disease-
III. Drafting a Community EAB Action Plan

Drafting an EAB Action Plan is a community effort which should have input from all concerned groups including: city tree care professionals, government officials, legal services, utility services, arborists, and private residents to list a few. It is a good idea to identify a Community EAB Action Plan development body containing representatives from each group. As plan development progresses technical committees can be further designated to address each of the core elements of a successful Community EAB Action Plan: 1) Statement of Purpose 2) Community Laws/Resources 3) Outreach 4) EAB Monitoring 5) Ash Tree Inventory 6) Ash Tree Management 7) Budgeting 8) Wood Utilization 9) Tree Replacement.

Additional Resources

http://emeraldashborer.info/index.php
http://dnr.wi.gov/topic/urbanforests/eabtoolbox.html
https://extension.entm.purdue.edu/EAB/
https://www.tn.gov/agriculture/topic/ag-businesses-eab#sthash.x401k6ci.dpuf
https://datcpservices.wisconsin.gov/eab/index.jsp
http://ctlb.ku.edu/en/developing-strategic-and-action-plans
http://www.dec.ny.gov/docs/lands_forests_pdf/eabplanwkbk.pdf
http://www.southernforests.org/urban
Statement of Purpose

A statement of purpose is a summary of a community's mission, objectives, and strategies for managing EAB. The mission is an encompassing statement of the community's overall intent. Objectives list specifics achievement goals and benchmarks. Strategies identify specific actions and are the guiding points of the action plan. Information should include the scope of work and intent for public safety, natural resources, budgets, and other local impacts. The statement of purpose may be revised after an action plan has been developed to include highlights on major recommendations, justifications, and costs.

Additional Resources
http://ctb.ku.edu/en/developing-strategic-and-action-plans
Community Laws/Resources

It is important to identify what local tree and ownership laws will impact EAB management. Tennessee state law includes no provisions for the removal of trees on private property. However, for example, in Nashville, there's a city tree removal ordinance which states that protected trees six inches or more in diameter on properties greater than those for one or two family home residences must have a permit before they can be removed, as they are considered “protected” trees. Identifying local laws, tree ordinances, regulatory bodies, ownership distributions, and jurisdiction will ensure community standards are upheld, individual responsibilities are clear, and confusion is avoided.

(Cited from www.treeeremoval.com)

While TDF grants are available for tree plantings there are no other federal or state funding sources for EAB management. Communities should identify what partner resources are available in order to mitigate the overall costs and ecological impacts from EAB.

Additional Resources

https://extension.tennessee.edu/publications/Documents/SP687.pdf
Outreach

The success of a Community EAB Action Plan lies in outreach. The document should be developed under advisement from community partners and in recognition of the multitude of contingencies in a community. The first step is always informing as many people in the community of the issue through meetings, events, posters, mail, email, radio, and TV. Where and whenever spread the word on emerald ash borer! The next step is stressing the tried and true success and importance of developing a plan for managing EAB. Sticking your head in the sand will only increase costs and limit the available management options.

Along with communicating information on emerald ash borer, the Don't Move Firewood campaign is also a powerful message that educates people on how firewood can be a vector to transport other tree killing pest and insects into the community. Firewood is a very likely transportation method for the emerald ash borer. The beetle is also known to travel in unprocessed ash logs, ash nursery stock, and other ash commodities as. It is very important to know where the emerald ash borer quarantines are if you are traveling between infested states or between counties that are known to be infested.

Additional Resources

https://www.dontmovefirewood.org/
http://www.emeraldashborer.info/documents/alertadeinsectoEAB.pdf
https://www.youtube.com/playlist?list=PLZ7LiLxtC3kfN_Druz9yS-s9F4-lj_sc1
http://www.hort.vt.edu/eab
http://emeraldashborer.info/eabu.php
http://stmedia.startribune.com/images/ows_137601663190634.jpg
Emerald Ash Borer Monitoring

Monitoring entails the placement of emerald ash borer traps baited with attractants in order to detect an infestation within a community. Unlike other pest monitoring programs, highly functional attractants for detection of EAB at low-moderate population densities have not been developed. While monitoring is an excellent tool, a community may find it difficult to install traps at a high enough density across the community. However placement of traps at high risk locations such as wood waste disposal sites and wood mills may provide an early detection of an EAB infestation. The number of traps which catch EAB and the number of EAB caught in each trap may help advise two main questions in developing a Community EAB Action Plan “How prevalent is EAB in the community?” and “What management options are available based on this stage of infestation?”

Additional Resources
Ash Tree Inventory

Before management of the ash in a community begins it is first essential to complete an inventory. If a recent tree inventory has already been completed it should be considered a valuable resource. This information is paramount to all other decisions and will assist in assigning jurisdiction, treatment recommendations, and designing a budget. **Without a tree inventory a Community EAB Action Plan has no foundation!**

### Additional Resources

- [http://forestry.ohiodnr.gov/portals/forestry/urbantoolbox/Inventory/HowtoConductSampleInventory.pdf](http://forestry.ohiodnr.gov/portals/forestry/urbantoolbox/Inventory/HowtoConductSampleInventory.pdf)
- [https://www.arborday.org/programs/treeCityUSA/](https://www.arborday.org/programs/treeCityUSA/)
- [https://www.utm.edu/departments/msanr/_pdfs/Brady%20Research%20Project%20Final.pdf](https://www.utm.edu/departments/msanr/_pdfs/Brady%20Research%20Project%20Final.pdf)

### Inventory Types

Based on the available funds, surveyors, and time a community should decide:

1. **Where should tree inventory data be completed?**
   This will depend strongly on the mission and objective of the community. Will public and private property be inventoried? Parks? Urban forests? Right of ways? Comprehensive 100% community tree inventories are the most valuable however they are expensive and timely. Instead representative samples of desirable management areas defined in the statement of purpose may be inventoried. Another option is a “windshield survey” where surveyors drive community roadways and record visible tree data.

2. **What type of tree inventory data should be collected?**
   Although a 100% community tree inventory data collection of every tree species is valuable in the long run (especially with future plantings) it may not be feasible while developing the Community EAB Action Plan. Inventory data of only ash trees will still provide essential information for the plan. The next most important piece of information is the tree diameter at breast height (DBH) which is the standard for measuring tree size and identifying costs for management. Individual tree position coordinates are especially informative for planning and tracking EAB management progress. Additional data categories may be included to fit the identified goals of the community. Additional tree data such as percent dieback of the tree canopy, tree height, presence of deadwood or cavities, level of EAB infestation, and overall health condition rating can provide better data when deciding the tree’s value and what management strategy to select for each tree. Additional site data such as tree location, egress/ingress issues, powerline location, and various other data points that may also be helpful for community to develop a management strategy.
Inventory Tools

In today's day and age there are many tools to assist in the collection and mapping of tree inventory data. Tablets, smartphones, Pocket PCs, Trimble, Garmin, and paper/pen (it still works!) can all be used to collect data. In addition there are many modes for recording data including free software, paid for software, excel sheets, and paper sheets.

Additional Resources

https://dffm.az.gov/sites/default/files/AZUTM_Tree_Inventory_Form_2014-12-15.doc
https://dffm.az.gov/sites/default/files/AZUTM_tree_inventory_spreadsheet_template_2015-02-04c.xls
http://www.itreetools.org/
Ash Tree Management

Good cultural practices are the cornerstone of individual tree care. Ash trees should be kept healthy by watering, mulching, pruning, and protection. This will not stop infestation however it will keep them healthy as long as possible. Pesticides are available to help combat the emerald ash borer however they must be applied prior to heavy infestation. Untreated trees that would pose a safety hazard when dead should be removed. Untreated trees may be salvaged where appropriate as determined by a professional consulting forester or by the TN Division of Forestry.

Additional Resources
https://extension.tennessee.edu/publications/Documents/Sp574.pdf

Chemical Treatment

There are several chemicals available for treatment of EAB. While chemical treatment is successful in inhibiting EAB infestation, it requires application every year or every several years. Due to this fact wide scale treatment of forested areas is impossible. Chemical treatment is recommended where, based on community decision, priority trees are located, or to defer tree removal until funds become available. All decisions should consider the ecosystem services provided by the tree, the cost of treatment (chemical, application method, labor costs), and the cost of removal (dead or alive) if necessary. During the peak outbreak of infestation more intensive chemicals applied by a certified applicator are required to prevent infestation. Tools in this documents' budget section have been included to identify a community's best course of action.

Additional Resources
http://www.emeraldashborer.info/documents/Multistate_EAB_Insecticide_Fact_Sheet.pdf
http://emeraldashborer.info/documents/Potential_Side_Effects_of_EAB_Insecticides_FAQ.pdf
http://www.emeraldashborer.info/documents/PM2084S%20(Spanish)%20EmeraldASHBorer_Iowa.pdf
Removal

Untreated ash trees will eventually die from EAB infestation. Where these trees will pose as potential safety hazards they should be removed prior to mortality. Not only are dead trees significantly more difficult and expensive to remove, EAB killed ash trees have been shown to undergo structural failure at the base and lower stems. These trees pose a significant safety risk to the public and during eventual removal. If contracting with a private arborist always ensure they are reputable, insured (property, liability, workers compensation), competitively priced, and a certified arborist through either the International Society of Arboriculture (ISA), the National Arborist Association (NAA) or the American Society of Consulting Arborists (ASCA).

Additional Resources
http://www.treeremoval.com/

No Action

Trees which go untreated and do not present a safety hazard should be left to undergo mortality. While an overall loss to the ecosystem, these trees will serve as ephemeral refuge and food source for a host of animals, plant, and fungi as they decay. In woodlots where treatment is not feasible and removal is unnecessary, avoid “knee jerk” reactions such as harvesting uninfested ash trees. Contact a professional forester or your local TDF office for more information on ash and EAB management. Management decisions should consider your current forest management objectives, the amount of ash in your forest, current ash markets, and your proximity to a known EAB infestation.

Additional Resources
https://www.tn.gov/agriculture/article/ag-forests-staff
**Budgeting**

It is first important to identify staffing needs and whether tasks can be performed by staff from other departments, agencies, or partnering organizations. Once you have identified roles, estimate plan implementation costs accordingly. Equipment needs should be identified and recommendations made for procurement and budgeting. This should include enlisting external support, such as mutual aid agreements with another municipality or utility, volunteers & service groups, businesses and other partners, grants, and community foundations. The final budget should include indirect and direct costs for planning, tree inventory, management, wood utilization, tree replacement, and outreach. Estimated values should be determined for the cost of chemical and equipment, tree removal, and labor (internal/external). Several tools (see below) have been developed for communities in order to budget and compare different management options. **The Purdue EAB Cost Calculator is highly recommended for entering real inventory data, management costs, and comparing strategies.**

![Annual Cost Comparison in Today's Dollars Over Time With a 0% Discount Rate](image)

![Total DBH Over Time with 2% Ash and 2% Replacement Tree Mortality](image)

**Additional Resources**

http://www.urbanreealliance.org/eab-costs/

http://int.entm.purdue.edu/ext/treecomputer/

https://www.michigan.gov/documents/dnr/EABPlanning_374200_7.xls

http://www.treebenefits.com/calculator/
Wood Utilization

By finding creative ways to create value-added products from the wood generated from ash tree removals, communities can often lessen the economic impact of the insect’s damage while strengthening local wood product industries. It can be very worthwhile to partner with local members of the wood industry. It may be possible to lower disposal costs by allowing businesses to use removed trees for mulch or fuel. Some communities have worked directly with local sawmills to see their trees turned into lumber and other products, many of which can be used for community projects. Regardless of which option is pursued, local residents generally respond positively to wood reuse programs, satisfied that their community trees are not going to waste. (Cited from [Link](http://dnr.wi.gov/topic/urbanforests/eabtoolbox.html))

Additional Resources

- [Transporting Ash Wood](http://datcpservices.wisconsin.gov/eab/articleassets/Transporting_Ash_Wood.pdf)
- [AgBusWoodusingindustries](https://www.tn.gov/assets/entities/agriculture/attachments/AgBusWoodusingindustries.pdf)
- [Dovetailurbanforests112014.pdf](http://www.dovetailinc.org/report_pdfs/2014/dovetailurbanforests112014.pdf)
- [Woodworkers](http://illinoisurbanwood.org/woodworkers/)
- [UtilizationOptionsForUrbanTrees.pdf](http://emeraldashborer.info/documents/wooduse/UtilizationOptionsForUrbanTrees.pdf)
- [Cost%20Effective%20Tree%20Removal.pdf](http://semircd.org/ash/news/Cost%20Effective%20Tree%20Removal.pdf)
Tree Replacement

How your community plans on replanting after EAB is another important element that should be included in your community's plan. Trees provide numerous benefits to the residents that live, work and play in your community. They remove pollutants from the air, help improve summer temperatures, reduce storm water runoff, and provide social and psychological benefits. They are also one of the only components of the urban environment that actually increases in value each year. During community tree replacement planning several factors should be taken into consideration including diversity of tree species, the right trees in the right place, proper planting/mulching, maintenance, volunteer availability, and TDF tree planting grant availability. (Cited from “Emerald Ash Borer Community Preparedness Plan”-Michigan)

Additional Resources

http://learningstore.uwex.edu/Assets/pdfs/A3864.pdf
http://emeraldashborer.info/documents/RightTreeLocation.pdf
http://emeraldashborer.info/documents/TreePlanting.pdf
https://www.tn.gov/agriculture/topic/ag-forests-seedlings
http://tectn.org/
IV. Contact Information

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