

Borough of Lewisburg

Emerald Ash Borer Management Plan Winter 2013/14

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Executive Summary

Lewisburg, Pennsylvania, like many small towns, benefits from its urban tree canopy. It does so in a number of ways that are valuable to humans, animals, and the environment. Among countless other resources, trees can act as landmarks, increase property value, and create a pleasant atmosphere. Urban canopies can add an economic value to homeowners and the community by decreasing heating and cooling costs by shading and insulating structures (homes and businesses); adding a windbreak to minimize the impact of storms and wind, and aesthetically enhancing properties. From a more organic or scientific perspective, trees provide many other assets, including reducing air pollution by filtering out carbon dioxide and other pollutants, providing oxygen generation, filtering water and minimizing soil erosion.

The Borough's ash trees are being infected and killed by an invasive species of insect. This infestation will continue to negatively impact the Borough, both environmentally and economically, for the next several years. The Borough has commissioned a management plan to address the issue of the Emerald Ash Borer (EAB), an invasive insect that "bores" into ash trees, destroying them in a few years' time. An EAB infestation results in 99% tree mortality four to five years after the initial attack, though the tree's pre-infestation health is a factor in the timeframe. Each female EAB can lay more than 100 eggs in a lifetime. The purpose of this plan is to manage the benefits from the urban tree canopy and to ensure the future enjoyment of the ecosystem's services provided, while responsibly managing the economics of ash tree treatment, removal and replacement.

The Borough will oversee a management plan over a period of 10 years (2014-2024) to mitigate the damages inflicted by the EAB. As of 2014, Lewisburg had a total of 249 ash trees (street and park trees) located within the public right of way in the Borough. The majority of those trees (201 ash trees) are located in the Lewisburg Area Recreation Park and Hunt Park, with the remaining trees (48 ash trees) located along residential streets of Lewisburg. The Borough will use a combination of management options that include removal of ash trees and replanting of new tree species; treatment of ash trees with insecticide; and removal of ash trees and non-replanting. It has been estimated, using Purdue University's EAB Cost Calculator, that the total cost to remove all of the ash trees and replant each with a new non-host species is approximately \$174,850.00 over 10 years. The bulk of this cost will be incurred during the first 5 years. The estimated total cost of treating all ash trees with an insecticide over the 10-year time frame is approximately \$107,860.00 (approx. \$27,000.00 biennially), based on using the insecticide TREE-äge. Other possible insecticide methods are mentioned in more detail in the "Management Approaches" section. This amount will be significantly less if a few carefully selected trees are treated, rather than all of the Borough's ash trees. The cost of removing all the Borough's ash trees without replanting a new species would be significantly less expensive than the above approaches, estimated at \$60,880.00 over a 10-year time frame (approx. \$7,500.00 annually). Of the listed options above, this management option places the least amount of financial burden on the Borough, but environmentally and aesthetically, may not be a sound option, though it may be a viable option for certain areas in the Borough (Hunt Park), which will be addressed later in this report. An example of a more discriminate, targeted combination treatment and removal approach is described in further detail later in this report (Management Approaches) and is illustrated in Table 2 in the Cost/Benefit section. These estimates are based on the total number of ash trees, *diameter at breast height* (DBH), the percent of ash trees that were infected in fall 2013, and approximate quotes received from local tree service providers for treatment, removal and replanting. However, an informal survey in spring 2014 revealed that the outbreak has progressed much more quickly than we had anticipated and it is likely that the initial costs may be underestimated.

Ash trees that are located on private properties are the responsibility of the property owner(s). Other municipalities in Pennsylvania have offered one-time monetary incentives to those property owners who agree to treat their ash trees with specific insecticides. This could be a potential option for Lewisburg to follow in the future, but for the time being public education will be the main focus of the Borough's attention to ash trees outside the public right of way.

This plan was made possible through support and training from DCNR's Department of Forestry's Ellen Roane, mentoring by Kendra McMillan (the project intern for the Promoting Emerald Ash Borer Management Plans in Pennsylvania Communities project), Gerald Hoy (the service forester from the Bureau of Forestry, Bald Eagle State Forest), and the Lewisburg Borough Shade Tree Commission (STC).

Community's Authority

The objective of the STC is to preserve, protect, and replace the shade trees within the Borough of Lewisburg for purposes of providing beauty, environmental health, enhanced property value, and wildlife habitat. The Commission stands to promote a healthy urban forest, and to educate and influence sustainable tree care and stewardship. The STC is authorized to perform its work along the Borough streets and public rights-of-way, and in municipal open spaces (http://www.lewisburgborough.org/shade_tree_info.htm).

The health of Lewisburg's ash tree population is threatened by the arrival and detection of the Emerald Ash Borer. As mentioned, the Borough has constructed a management plan to address this issue. The plan is in correlation with the guidelines set forth by the management plan prepared by the Pennsylvania Department of Conservation and Natural Resources (PA DCNR) in July 2013. Below is a declaration of the Borough and the STC policies and procedures that are already in existence and will affect the execution of the proposed management plan.

Existing Policies:

(1) Removal of Dead or Diseased Trees

The Commission may upon notice require the owners of real estate to cut and remove diseased shade trees located upon or along their property, which threaten to injure or destroy persons, property, or other shade trees in the Borough. The notice shall give the owner at least 20 days in which to comply, and shall include instructions on how the shade tree is to be cut and removed. The cost of cutting and removing any dead or diseased shade tree shall be borne by the owner of the real estate. Upon failure or refusal of any such owner to comply with such notice, the Commission may cause the work to be done by the Borough and levy and collect the cost thereof from the owner.

[Amended 1-20-1987 by Ord. No. 824]

(2) Payment by Owners, Maintenance by Borough

- (a) The cost of planting, transplanting, or removing any shade tree in and along the public highways, of the necessary and suitable guards, curbing, or grading for the protection thereof, and of the replacing of any pavement or sidewalk necessarily disturbed in the execution of such work shall be paid by the owner of the real estate abutting which the work is done. The amount each owner is to pay shall be ascertained and certified by the Commission to the Borough Council and to the Borough Treasurer. The Borough shall pay the cost and expenses of caring for such trees after having been planted. The needed amount for such care shall each year be certified by the Commission to the Borough Council and shall be drawn against, as required by the Commission, in the same manner as money appropriated for Borough purposes.

[Amended 8-16-1978 by Ord. No. 78-13]

(3) Permits Required

No person shall without first having obtained a permit therefore:

- (a) Plant any shade tree in or along any public highway or which extends over or within the lines of any public highway, such permit to designate where such tree is to be planted. The Commission may refuse a permit to plant any species of tree, which in its opinion is not suited to the location.
- (b) Cut down, break, climb with spurs, injure in any manner or remove any shade tree; or cut or interfere in any way with the main roots of any shade tree; or place any rope, guy wire, cable, sign, poster, or any other fixture on any shade tree or guard for any shade tree; or injure, misuse, or remove any device placed to protect any shade tree except in case of immediate necessity for the protection of life and property.
- (c) Place or maintain any cement or nonporous substance or material which shall impede the passage of water and air to the roots of any shade tree.
- (d) Attach any electric wire, insulator, or any device for the holding of an electric wire to any shade tree.

(4) Permits and Ordinances

- (a) A permit is required for the removal or the planting of any tree located in the right-of-way within the Borough of Lewisburg. If a removal of a tree is approved, the Shade Tree Ordinance in Lewisburg allows the STC to require replacement of that tree.
- (b) Applications for permits must specify the location of where the proposed (new) tree is to be planted and the tree species must be identified. The Commission may refuse a permit to plant a species of tree, which in its opinion, is not suited to the location.
- (c) Applications for permits are reviewed monthly at the public Shade Tree Commission meeting. Specific ordinances that homeowners should be aware of include the allowed height of the branches. On the sidewalk side, a tree cannot have branches that are below 9 feet; on the street side, the branches cannot be lower than 15 feet. This allows people and vehicles safe passage. However, remember that trees should not be aggressively pruned until they reach a 5" caliper. The Borough is required to keep these passages clear, and so has the legal right to trim branches to these specified heights without notice.
- (d) To see the detailed ordinances regarding shade trees, please click on the "Borough Codes-Online"

tab located on the Borough's homepage.

Public Nuisance:

The Emerald Ash Borer has been defined as a nuisance to the Lewisburg Borough and its shade trees. Other definitions of public nuisances include:

- (1) Any living trees on Borough property infested with the pest.
- (2) Any dead trees or wood on Borough property infested with the pest.
- (3) Any transported wood brought onto Borough property infested with the pest.

Jurisdiction:

The Shade Tree Commission is granted authority to address EAB-related public nuisances through the process of treatment, removal, or other action to stop the spread of the infestation within the Borough of Lewisburg.

Inspection:

The STC will employ a trained inspector/surveyor to maintain up-to-date health status of the identified ash trees within the Borough's jurisdiction.

Cost of Abatement:

Cost of abatement is dependent on location of the affected tree and/or means of receiving the affected wood. The Borough, property-owner, or transporter could bear the cost of abatement.

Violations:

Transporting affected or infested wood without proper permitting by the Borough is strictly prohibited.

Definitions

Selective Management – In this option, high-value ash trees in selected areas (streets, landmarks, historic sites, popular parks, important ecological sites, etc.) within the community will be managed actively, whereby a great portion of high-value ash trees are protected for future generations to enjoy. In addition, dead or dying ash trees in streets and parks will be replaced with non-host species to prevent major canopy gaps in neighborhoods. Annual cost for this option will be moderate to the community, with minimal disturbance to the urban forests. Habitat change in untreated natural areas will be expected.

Preemptive Management – In this option, ash trees in urban areas (streets, parks, golf courses, etc.) will be removed preemptively and replaced with non-host species, whereas those in natural areas (e.g. woodlands) will be left alone. No EAB survey activity will be conducted. As a result, treatment areas will contain no ash trees, with no concerns over EAB in the future either. The initial cost of this option could be very high because of expenses associated with tree removal and replacement. Neighborhoods will also face major canopy gaps until the replacement trees become well established. However, no annual cost will be incurred after the completion of the project. Habitat change in untreated natural areas will be expected.

Aggressive Management – In this option, all ash trees in the community will be managed actively with all available management tools. EAB survey activities will be carried out on both roadways and woodlands. Information from the surveys will be used to determine proper management actions across different landscapes. Chemical control will be actively pursued to protect the maximum portion of ash trees and their

canopy. Only dead or dying ash trees will be removed and replaced with non-host species. Biological control (including insects and other natural enemies of EAB) will also be considered for ash resources in the natural areas. As a result, most high-value ash trees in the streets and parks will be saved from EAB damage, whereas only a small portion will be replaced with non-host species. In addition, ash resources in natural areas may have a chance to survive in the long term when effects of introduced natural enemies are realized. With this method the community will suffer the least social and environmental impacts from the infestation, with the least risk of losing urban canopy cover. However, annual cost to the community will be the highest among all options.

Diameter at Breast Height (DBH) – The standard method of expressing the diameter of the trunk of a standing tree at the height of 4.5 feet above the ground, on the uphill side of the tree.

Introduction

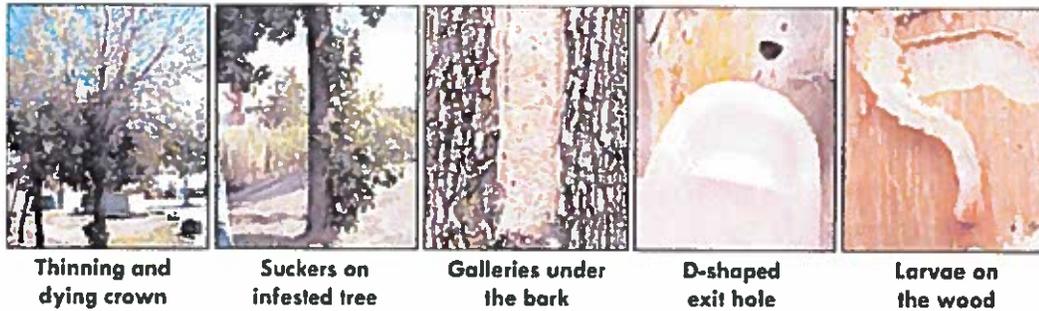
The Borough of Lewisburg, PA is a beautiful municipality in the Central Susquehanna Valley. It prides itself on maintaining its rich historical architecture throughout its quaint neighborhoods, and the ample numbers of shade trees around town and in the parks serve to further enhance the beauty of the community. Using the guidelines and models set forth by the PA DCNR's Bureau of Forestry, the Borough was able to develop a management plan to protect the shade trees of the Borough as well as to minimize damage and risks to public safety in an economically-viable manner.

The EAB, *Agrilus planipennis*, was first discovered attacking ash trees in Southeast Michigan in 2002. Since then, it has been found in 20 additional states and two Canadian provinces across the Great Lakes region and beyond. It was first detected in Pennsylvania's Butler County in 2007 and was detected in Bucks County in 2012. A total of 37 counties are currently infested and the entire state is under federal quarantine.

An EAB infestation results in 99% tree mortality four to five years after the initial attack, though the tree's pre-infestation health is a factor in the timeframe. Each female EAB can lay more than 100 eggs in a lifetime. These eggs are deposited on the outside of an ash tree trunk or on the branches. Once hatched, the larvae "bore" into the phloem of the tree, where they disrupt the tree's water and nutrient transport. In the spring the adult EAB emerge from the trunks creating "D-shaped exit holes", which are a hallmark of an EAB infestation. One week after exiting, the adults mate and then move to the tree canopy to feed on leaves. Two to three weeks later the fertilized eggs hatch, thus continuing the cycle. Adult EAB can fly up to half a mile from where they hatch, but most infestations begin through exposure to infested wood such as firewood, logs, or nursery trees.

Some signs and symptoms of the EAB include:

- (1) Crown dieback, beginning in the top 1/3 of canopy and progressing until the tree is bare
- (2) Epicormic shoots (suckers) growing from the roots and trunk, often with abnormally large leaves
- (3) Bark splitting with vertical fissures on the bark due to callous tissue formation and exposed galleries beneath the splits
- (4) Serpentine galleries and D-shaped exit holes, often packed with frass (a mixture of sawdust and excrement)
- (5) Increased woodpecker activity/damage. Several woodpecker species feed on the EAB larvae/pupae, peck the outer bark while foraging, and create large holes when extracting insects



The goals of this management plan are as follows:

- (1) Protect and treat valuable ash trees within the Borough
- (2) Remove hazardous or untreatable trees to reduce public risk
- (3) Replant non-host species to replace the removed ash trees

Ash Resources

The ash tree inventory of the Borough is current as of March 2014. The total ash tree population in the Borough's public rights of way stands at 249 trees, with a total DBH for the Borough's ash trees at 4,650 inches, and a DBH range of 3 to 31 inches. Most of the ash trees in the Borough (43%) have a DBH of approximately 20 inches (18-24) (24% have a DBH of 12 to 18 inches, and 21% have a DBH of 24 to 30 inches.

Map 1: Ash tree distribution in Lewisburg, PA



EAB Infestation

There have been two specific known incidents in the Borough in regards to the EAB infestation/migration. One was discovered by Kendra McMillan of the PA Urban and Community Forestry Council and Gerald Hoy of the Bureau of Forestry during an August 2013 training. A stand of ash trees was identified in the "Kidsburg" playground/park area. All three trees showed severe symptoms of the EAB, including woodpecker markings and D-shaped exit holes. The crowns had died back significantly and there were a multitude of dead branches. Photos were taken to document the discovery and to share with other communities. This sighting led Kendra to believe that EAB would be widespread in the Borough's ash trees, requiring many removals.

The second major EAB incident in the Borough was at the Lewisburg Area Recreation Park, also referred to as the St. Mary Street Park. Gerald Hoy identified some hazardous ash trees and recommended they be removed

during the 2013-2014-winter season. The trees were removed, (3 in L.A.R. Park, 6 in Kidsburg) which required a temporary closure of the park. Whether the dieback/poor health of these ash trees was related to the EAB is unclear. As mentioned, there is a large stand of ash trees located in the Hunt Park area off of St. Mary Street nearby the L.A.R. Park that, while showing definite signs of disease, old age, or otherwise poor health, does not show explicit signs of an EAB infestation. There are a total of 201 ash trees in L.A.R. and St. Mary Street parks combined.

While there have been incidences of EAB infestation in the Borough, the epidemic has not yet spread rapidly. With the focused attention to the issue and the development of a management plan at this early stage, the EAB invasion and subsequent costs will be closely examined.

Management Approaches

There are four categories of management approaches laid out by the Pennsylvania Department of Conservation and Natural Resources Bureau of Forestry. These include No Action, Selective Management, Preemptive management, and Aggressive management. Any action-based management approach could include one or more of the following tactics: chemical treatment, tree removal, biological control and non-invasive tree replanting. Of these techniques, the Borough will implement all approaches with the exception of biological control, since there is not yet a reliable biological approach. The options and techniques that the Borough is discussing for EAB management vary quite a bit in economic as well as environmental and ecologic cost. The Borough and Shade Tree Commission's priority is in maintaining equal and fair consideration of all these costs.

The first priority for the Borough will be to remove all dead trees, therefore removing any danger or risk of damage to property or injury of individuals. This will be done immediately upon completion of a tree inventory and approval of the Borough. As with the following management options, the decision will be made by the STC regarding which of the removed trees will be replaced and with what species they will be replaced. The second priority will be for the Borough and Shade Tree Commission to identify all infected ash trees and to prioritize which are more affected and the extent to which the trees are damaged (i.e. crown die-back, increased woodpecker damage, etc.). The STC then will prioritize which infected trees will be removed (as with some of the following management options) determine if they will be replaced or not, and decide on replacement species. For instance, the Borough may prioritize ash trees with 50% or more crown dieback as trees that need to be removed and replaced, but trees with less than 50% crown die-back may be managed in a different way. The Shade Tree Commission and the Borough have various resources available for choosing replacement trees according to the tree's surrounding environment and structures. A third priority for the STC and the Borough will be to evaluate the possibility of treating the Borough's ash trees with a chemical insecticide. A detailed explanation of chemical treatment and the different options for insecticides is listed below, along with two management options that involve the TREE-age chemical injection system. The Borough and STC will need to decide, based on the findings of an ash tree infection inventory, which Borough trees should be treated with an insecticide. They also will need to evaluate costs of treatment based on the options outlined below as well as considering the possible need for further treatments in the future. This will require ongoing monitoring of treated trees to maintain an inventory of which trees are positively reacting to the chemical treatments.

A combination of the options listed below would likely be an approach that would be desirable if utilized by the Borough of Lewisburg. It would potentially cut costs while helping to maintain the urban forest environment currently provided by the ash trees. While examining Table 1 below, it is apparent that all of the treatment approaches listed require a cost of \$0 for the first year and it also shows that it takes less time to remove and replace ash species than to just remove the ash trees. This may bring forth questions of the accuracy of the tables/charts. To clarify, these numbers have been calculated utilizing the Cost Calculator from Purdue University and the cost therefore has been spread out over a time period to lessen the financial strain on the Borough. Also, the time frame illustrates a shorter period for replacing trees due to the environmental and aesthetic issues of leaving empty spaces where ash trees once were. With that being stated, the time frames are relative numbers for comparison purposes and can be changed to the needs of the Borough of Lewisburg. These options are as follows:

Option 1: Treat All Ash Trees

With the details of chemical treatment being stated below, the Borough could consider treating all of the street and park ash trees as a management option, using the TREE-äge chemical insecticide. This option would be one of the least expensive annual out of pocket approaches, but a more expensive method over time. This option would require a professional landscaper or arborist with the proper chemical administering licenses to administer the insecticide treatment to all 249 of the Borough's ash trees. The process of administering the TREE-äge chemical, via the Arborjet system takes approximately 20 to 45 minutes per tree, therefore it would require 1 to 2 years to treat all of the trees. As stated previously, this particular treatment lasts for 2 years and has been proven to be very effective against EAB, but the Borough should be prepared to continue to monitor the effectiveness of the treatment. The cost of continually treating all ash trees in the Borough (as shown in Table 1) over a 25-year period would be approximately \$230,500.00. If the Borough were to treat all the ash trees only once (which has not been proven to be effective), the approximate cost would be \$31,000.00 over 2 years, which is a very small economic expense compared to other methods, but with the likely risk of not having any significant result to show for the money spent. Most urban forests have trees that are in such a poor condition that they are deemed not worth saving, and this is definitely something to take into account when deciding a management plan that includes chemical treatment. Also, research has demonstrated that chemical treatment (i.e. TREE-äge) has helped maintain healthy ash trees only until they reach a size of approximately 25 dbh, after which the trees are sometimes too large to recover or save.

Chemical Treatment

The chemical treatment approaches available for EAB management include soil injection (Xytect) and tree injection (TREE-äge) methods, as well as a combination soil injection/bark spray (Transtect). Moist soil is a requirement for the Xytect injection method to be successful; it allows for the tree to absorb the chemicals through its roots and draw it up through the trunk and into the canopy. Transtect spray would be applied to either the trunk or the tree branches. This is known as a "protective cover spray" and kills adult beetles and newly hatched larvae, but not eggs. Of the listed insecticide treatments, the Borough will likely be utilizing the TREE-äge insecticide for its management of the EAB. TREE-äge is 99% effective against EAB larvae and only needs to be applied once every two years. A one-year study conducted by entomologist Dr. Deborah McCullough from Michigan State University found that in trees treated with other insecticides, there were on average 14 to 62 EAB larvae remaining and on average 0.2 larvae remaining after being treated with emamectin benzoate (TREE-äge). The control trees that were not treated had on average 68 to 132 larvae

remaining. Due to its cost and projected survival rates, only healthy trees should be considered for this treatment. It is a tree injection-based approach used for addressing invasive pests. Its active ingredient is emamectin benzoate, which has been approved by the EPA for treating pests. Emamectin benzoate is injected into a tree's vascular system. It is not sprayed on the bark or leaves. Animals (e.g. birds, chipmunks) and other insects (e.g. butterflies) that simply land on a treated tree but do not feed on the tree will not be affected by the insecticide. One liter treats approximately 33 trees, with an average dbh of 10". A licensed or certified arborist or landscaper may only administer this insecticide. The approximate cost of this treatment is \$6.25/inch of DBH.



A list of TREE-äge vendors in Pennsylvania and more insecticide info can be found at:

http://arborjet.com/arborjet_near_you/find_a_distributor/ or

http://www.emeraldashborer.info/files/multistate_eab_insecticide_fact_sheet.pdf

http://www.emeraldashborer.info/files/multistate_eab_insecticide_fact_sheet.pdf

Option 2: Remove All without Replanting

A more undefined approach to managing the EAB in the Borough is also possible. This would include, as stated, a complete felling of ash trees in Hunt Park, but also removal of all of the ash trees throughout the Borough as well. This method of treatment would cost the Borough approximately \$61,000.00 over a ten year period. Although this technique has a minimal financial cost, the ecological and aesthetic toll that would be inflicted on the Borough and its neighborhoods would be undesirable. If these areas were left bare without any new tree species in their place it would be detrimental to many areas of concern, including bird habitat, property values, and heating and cooling costs. Using this method would also risk felling completely healthy ash trees, or ash trees that can unquestionably be treated against the EAB invasion. It will be necessary to remove some trees that threaten properties and individuals, but to remove all of them without replacement would have a long lasting negative impact on the Borough.

Option 3: Selective Removal and TREE-äge Treatment

A more flexible method of using selective removal along with insecticide treatment throughout the Borough would be another option to consider. This would be managed as follows: aside from Hunt Park's ash trees, approximately 36 (33.3% or one-third) Borough ash trees will be removed. Of the remaining 73 (66.6% or two-thirds) ash trees, 48 will be treated ONCE, and the other 24 will be treated TWICE. This method, with an estimated cost of \$68,000.00 over a ten year period, is less expensive than some of the other approaches and more expensive than some of the others. However (due to the trees only being treated with TREE-äge once and twice), this approach needs to be carefully monitored with ongoing attention being paid to the health of

the Borough’s tree canopy in order to protect the safety of the Borough residents below. The estimated costs of this approach are illustrated in Table 2 below.

Option 4: Remove and Replace All Ash Trees

An approach in opposition to the Remove All of Option 2 would be to remove all ash trees in the Borough and in the parks, and to immediately replant another species of tree in their place that is EAB resistant. Many maples, elm and other tree species can be planted in place of the removed ash trees to fill those empty sites and habitats. The approximate total cost for the Borough (as illustrated in Table 1) of utilizing this method would be \$174,000.00, with that amount being spent in the first five years of the EAB management effort. This is an environmentally and aesthetically pleasing method, but obviously it is more economically exhausting on the Borough than some of the other options.

Option 5: Urban SLAM

Strategy	Description	Why Important
Urban Slam	This plan treats & protects 40% of the forest with TreeÄge. This is accomplished by applying the product to 20% of the trees each year. This strategy must be maintained until year 12 when the invasion wave has passed. Treatment should be deployed	This strategy slows the mortality of ash trees when adults feeding on treated ash are killed. It has the potential to protect 100% of the ash trees in an area by only treating 40% of the trees. A complete tally of all ash trees on streets and on private property is needed to determine the number of trees that must be treated for this strategy to be successful. Using cost quotes for treating trees with TREE-äge you can compare this

	randomly and should not focus only on infested trees	strategy to Replace Unsafe Ash and Replace All to determine if an areawide program makes sense for you
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A
new

management approach (piloted in 2008) that might be utilized by the Borough is known as the Urban SLAM (SLOW Ash Mortality) method. The goal of this method is to slow the onset and progression of the ash tree mortality by slowing the progression of the EAB insect population. This involves strategically applying insecticide treatment (TREE-äge) to the Borough's trees (approximately 40% of all trees) annually for a period of at least 12 years. This time frame requires attention beyond the projected 10-year timeline, but in order for this method to be effective, it must be continually applied. Each year, 20% of the Borough's entire ash tree population will be randomly treated, with both infected and non-infected ash trees being treated. This method is economically more appealing than treating all of the street ash trees, as well as removing and replacing all of the Borough's street ash trees. Additionally, it would be less costly than removing ALL street ash trees in the Borough (approx. \$ 61,000.00 over 10 years). If the Borough were to use Urban SLAM on primarily just the street ash trees throughout the community and not the Hunt Park trees (due to their complete removal and non-replacement) the total cost would be approximately \$35,000.00 (\$9,500.00 for Urban SLAM on Borough ash trees; \$25,600 for complete felling of Hunt Park trees). This is a large amount of savings compared to other methods listed.

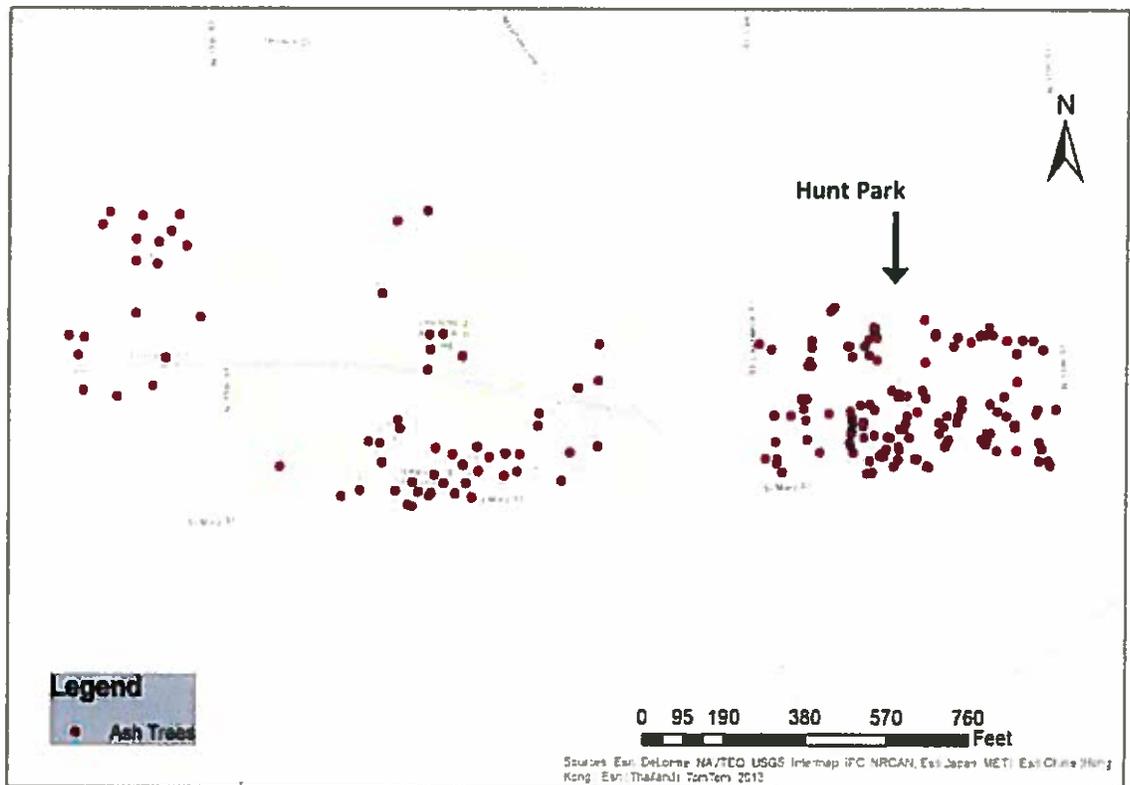
The estimated cost of using the Urban SLAM method for ALL of the Borough's ash trees, including treating Hunt Park's ash population, is approximately \$52,000.00 over a 20-year period and \$69,000.00 over a 25 year period. This method and the variations concerning Hunt Park appear to offer an economically attractive approach to EAB management. The cost analysis of the Urban SLAM method (with and without Hunt Park's tree removals) is illustrated in Table 3(Cost/Benefit section). It would also be helpful to contact Purdue University via email for further assistance in utilizing Urban SLAM. They are open to inquiries regarding the SLAM method and other approaches, and can be contacted at forestpests@purdue.edu.

Hunt Park

The Hunt Park section of the L.A.R. Park is a green, wooded space between St. Lawrence and N. 11th Streets, which sees much less traffic than other areas of the park. This is a section of the Borough that may benefit from selective management (i.e. removal and non-replacement of trees). In addition to removing a potential hazard, the cleared area would provide park visitors with added open space for field activities, like soccer and disc. If this method of management is implemented in this area, it would decrease the Borough's potential spending drastically for several reasons: a logger would give his best price for just such a mass removal; a mill would most like to buy such a large, consistent supply of lumber; and money would not be spent re-planting 200 trees. On the other hand, this is lowland, almost wetlands, and there may be hydrologic consequences to removing this many trees from this particular environment.

Map 2:

L.A.R. Park and
Hunt Park Ash
Trees



Wood Utilization and Material Disposal

Ash trees that have been affected by the EAB are not useless. As the EAB does not damage the interior wood, the trees can still be used for many things, including lumber. Ash wood makes a good replacement for oak and can be used for a variety of projects, including furniture, flooring, paneling, and molding. Historically, ash has been used for firewood, as well as for utilitarian uses such as handles for tools and instruments. Recent reports by Deb McCullough of Michigan State University's Dept. of Entomology indicate that ash wood from trees treated with TREE-äge is safe and suitable for these uses, too. The wood is also a food source for the larvae of some species of butterflies or moths. Ash leaves and branches, when harvested in the autumn, can be used as food for domestic animals such as cows, goats, and rabbits. These values should be taken into account to regain the lost economic value of the removed or fallen trees. The Borough paid \$1,200.00 to remove 3 trees in L.A.R. Park and those trees were then sold to a lumber dealer for \$300.00. A similar approach should be taken throughout the management of the EAB infestation to mitigate the economic loss to the Borough.

Community Outreach

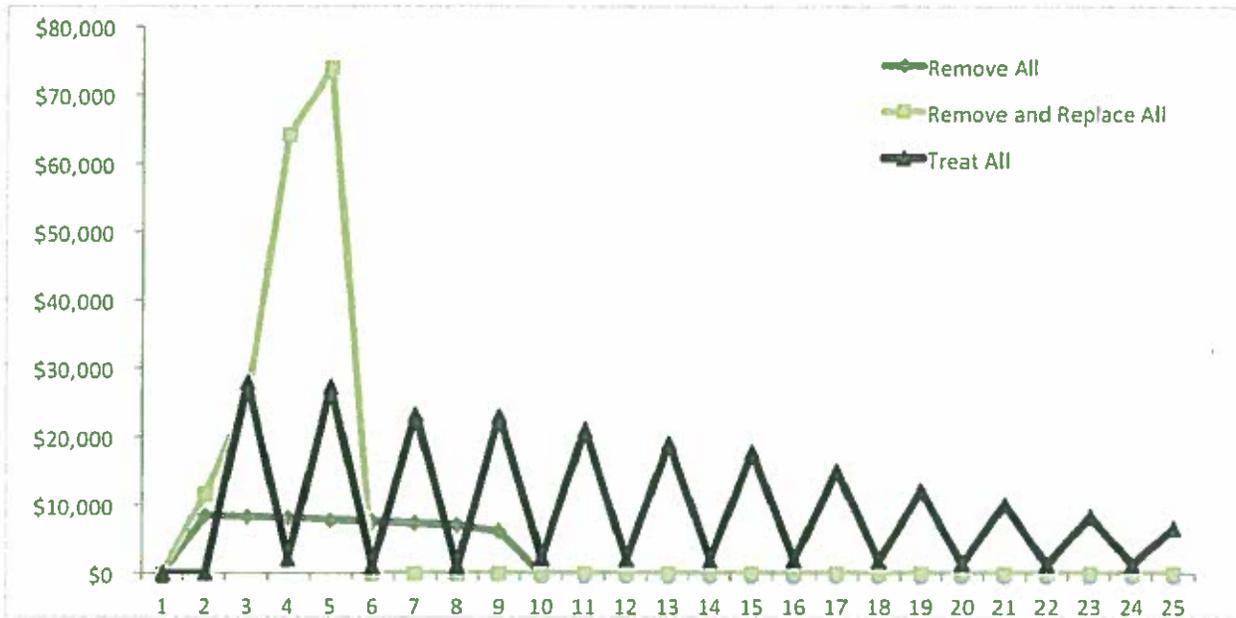
The STC has distributed brochures and EAB identification cards to households in the Borough directly affected by the EAB infestation. Continued communication between homeowners/community members, the Borough Council, and the STC regarding the EAB situation and its impact on the Borough will be needed. Future opportunities to educate the public about the EAB, its threat, and management options might include: articles in local newspapers; the Borough's annual Arbor Day Celebration held at the end of April; or a public community meeting for residents and homeowners.

Cost/Benefit Analysis

Charts and graphs have been created using the Purdue University Emerald Ash Borer Cost Calculator, which helps municipalities to generate environmentally and fiscally sound management plans. The data entered into the calculator is based on the ash tree (street and park tree) inventory of the Borough. As mentioned, the total street and park tree inventory of ash trees in the Borough is 249. Approximately 200 ash trees are within the Lewisburg Are Recreation Park and Hunt Park, near St. Mary and N. 15th Streets, and St. Lawrence and N. 11th Streets. The residential/downtown portion of the Borough accounts for the other approximately 45 ash trees. These numbers, along with DBH and health status, were used to calculate the costs of managing the EAB pest in the Borough. The cost calculator charts and graphs were generated based on the Borough's figures and today's market estimates.

Cost Timelines for Lewisburg EAB Management Plans

Annual Cost Comparison in Today's Dollars Over Time With a 3% Discount Rate



Cumulative Cost Comparison in Today's Dollars Over Time With a 3% Discount Rate

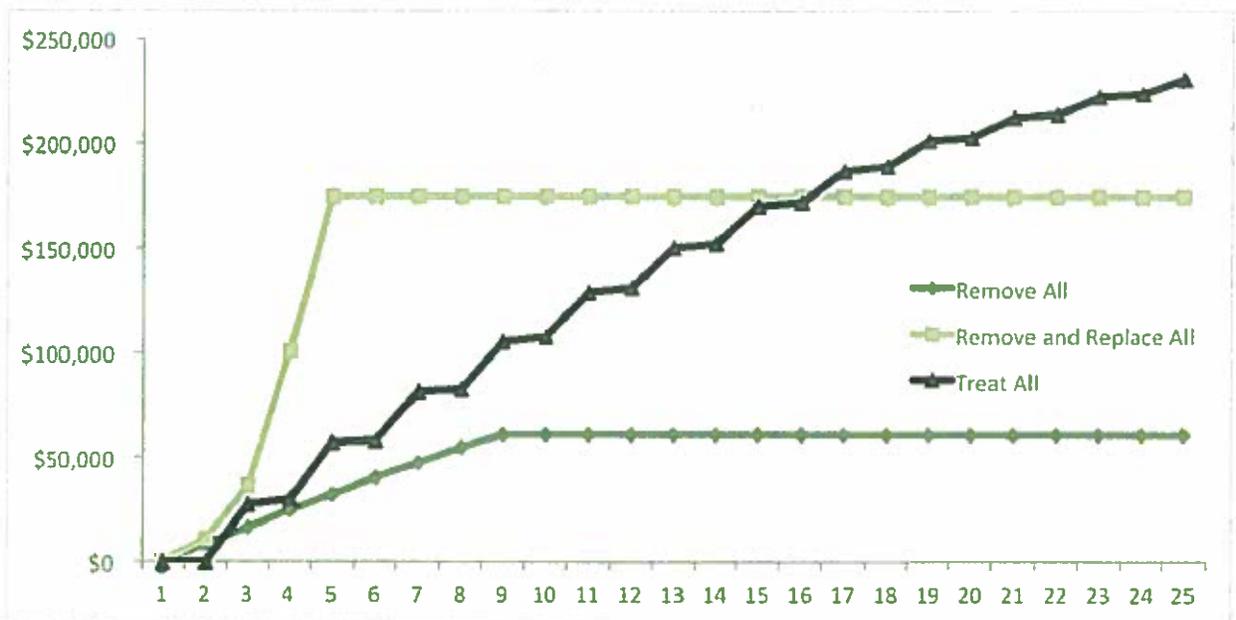


Table 1: Costs of Treatment Methods Comparison

Year	Remove All		Remove and Replace All		Treat All	
	Cost This Year	Total Cost	Cost This Year	Total Cost	Cost This Year	Total Cost
1	\$0	\$0	\$0	\$0	\$0	\$0
2	\$8,456	\$8,456	\$11,533	\$11,533	\$0	\$0
3	\$8,203	\$16,659	\$25,265	\$36,798	\$27,869	\$27,869
4	\$8,037	\$24,695	\$64,059	\$100,857	\$2,161	\$30,030
5	\$7,855	\$32,551	\$73,991	\$174,849	\$27,294	\$57,325
6	\$7,718	\$40,269	\$0	\$174,849	\$1,017	\$58,341
7	\$7,309	\$47,577	\$0	\$174,849	\$23,303	\$81,614
8	\$7,098	\$54,675	\$0	\$174,849	\$973	\$82,617
9	\$6,206	\$60,881	\$0	\$174,849	\$22,982	\$105,599
10	\$0	\$60,881	\$0	\$174,849	\$2,264	\$107,862
11	\$0	\$60,881	\$0	\$174,849	\$21,103	\$128,966
12	\$0	\$60,881	\$0	\$174,849	\$2,176	\$131,141
13	\$0	\$60,881	\$0	\$174,849	\$19,054	\$150,196
14	\$0	\$60,881	\$0	\$174,849	\$2,071	\$152,267
15	\$0	\$60,881	\$0	\$174,849	\$17,771	\$170,039
16	\$0	\$60,881	\$0	\$174,849	\$2,001	\$172,039
17	\$0	\$60,881	\$0	\$174,849	\$15,043	\$187,083
18	\$0	\$60,881	\$0	\$174,849	\$1,932	\$189,015
19	\$0	\$60,881	\$0	\$174,849	\$12,194	\$201,209
20	\$0	\$60,881	\$0	\$174,849	\$1,435	\$202,644
21	\$0	\$60,881	\$0	\$174,849	\$10,186	\$212,830
22	\$0	\$60,881	\$0	\$174,849	\$1,380	\$214,210
23	\$0	\$60,881	\$0	\$174,849	\$8,381	\$222,591
24	\$0	\$60,881	\$0	\$174,849	\$1,349	\$223,940
25	\$0	\$60,881	\$0	\$174,849	\$6,721	\$230,661

Table 2: Targeted-Combination Management Approach Potential Cost

Year	Cost This Year	Total Cost
1	\$15,673.25	\$15,673.25
2	\$5,460	\$21,133.25
3	\$8,867	\$30,000.25
4	\$5,460	\$35,460.25
5	\$5,460	\$40,920.25
6	\$5,460	\$46,380.25
7	\$5,460	\$51,840.25
8	\$5,460	\$57,300.25
9	\$5,460	\$62,760.25
10	\$5,460	\$68,220.25
11	\$0	\$68,220.25

12	\$0	\$68,220.25
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Table

Urban Slam		
Year	Cost This Year	Total Cost
1	\$0	\$0
2	\$0	\$0
3	\$3,337	\$3,337
4	\$0	\$3,337
5	\$3,306	\$6,643
6	\$0	\$6,643
7	\$3,279	\$9,922
8	\$0	\$9,922
9	\$3,254	\$13,175
10	\$0	\$13,175
11	\$3,231	\$16,406
12	\$0	\$16,406
13	\$3,210	\$19,616
14	(without Hunt Park)	\$19,616
15	\$3,191	\$22,807
16	\$0	\$22,807
17	\$3,173	\$25,980
18	\$0	\$25,980
19	\$3,157	\$29,137
20	\$0	\$29,137
21	\$3,142	\$32,279
22	\$0	\$32,279
23	\$3,128	\$35,407
24	\$0	\$35,407
25	\$3,115	\$38,522

**Table 4: Urban S.L.A.M. Potential Cost in Lewisburg
(All Street and Park Trees)**

Urban Slam		
Year	Cost This Year	Total Cost
1	\$0	\$0
2	\$0	\$0
3	\$6,036	\$6,036
4	\$0	\$6,036
5	\$5,978	\$12,014
6	\$0	\$12,014
7	\$5,926	\$17,940
8	\$0	\$17,940
9	\$5,879	\$23,819
10	\$0	\$23,819
11	\$5,836	\$29,655
12	\$0	\$29,655
13	\$5,797	\$35,452
14	\$0	\$35,452
15	\$5,761	\$41,213
16	\$0	\$41,213
17	\$5,728	\$46,941
18	\$0	\$46,941
19	\$5,697	\$52,638
20	\$0	\$52,638
21	\$5,669	\$58,307
22	\$0	\$58,307
23	\$5,643	\$63,950
24	\$0	\$63,950
25	\$5,618	\$69,568

Timeline

The Borough, which is known to be affected by the EAB, will have to contend with this issue for at least the next several years. It is reasonable to set a preliminary timeline of 10 years to address this problem. This timeframe will include a removal, treatment, and replacement schedule. The removal of ash trees will be an annual task (cost shown in cost/benefit graphs) and will take place for 9 of the 10 years, but it may take longer depending on budgeting constraints. The treatment of ash trees (using TREE-äge) will also take place throughout the 10 year time period (unless utilizing the Urban SLAM method), but the insecticide will only need to be administered every 2 years (most cost efficient of insecticide treatments). Insecticide treatment beyond the 10 year time-frame, as with the Urban SLAM approach, would increase the total cost for the Borough.

The actions that will be carried out over the next 10-15 years include:

- (1) Chemical treatment of affected ash trees (biennially for selected trees)
- (2) Removal of untreatable or high-risk trees (start removing in 2014 and finish in 9th year)
- (3) Proper utilization or disposal of ash materials (ongoing throughout)
- (4) Monitoring of the health conditions of untreated, non-removed ash trees (ongoing)
- (5) Update of street tree inventory and other policies (ongoing)
- (6) Public education and involvement in and about urban tree management (ongoing)

Conclusion

As of March 2014, the Borough of Lewisburg has compiled data regarding the Emerald Ash Borer and its future impact on the community's ash tree population. The data was used to construct this management plan and will continue to be used to help mitigate the EAB in the Borough. As for the future of the EAB problem, more data, including infection rates, tree inventories, and mapping will need to be updated accordingly, as well as subsequently altered due to new information. Also, due to budgeting, new or updated management approaches may be explored to better suit the needs and abilities of the Borough.

Contacts and Further Resources//Information

- Borough of Lewisburg, Shade Tree Commission
- PA Community Forests
- Department of Conservation and Natural Resources (DCNR)
- www.emeraldashborer.info
- www.americanforests.org "Urban Forests"
- <http://extension.entm.purdue.edu/treecomputer/>
- <http://www.emeraldashborer.info/treeage.cfm#sthash.sfqmwx1f.Mpsn4iF5.dpbs>

Works Cited

Liu, Houping. "Lunchtime Webinar Series." *PA Community Forests*. Penn State Extension, May 2013. Web.
 McMillin, Kendra. *Emerald Ash Borer Management Plan, Borough of West Chester, PA*. Rep. West Chester: Borough of West Chester, 2012. Print.

"Emamectin Benzoate Pesticide Now Registered for Use in Treating Ash Trees for Emerald Ash Borer (EAB) - See More At: [Http://www.emeraldashborer.info/treeage.cfm#sthash.sfqmwx1f.yAW9FTe2.dpuf](http://www.emeraldashborer.info/treeage.cfm#sthash.sfqmwx1f.yAW9FTe2.dpuf)." *Emeraldashborer.info*. USDA Forest Service, Michigan State University, Purdue University, Ohio State University, May-June 2013. Web. Feb.-Mar. 2014.

Acknowledgements:

Grant funding supported through the USDA Forest Service <http://www.fs.fed.us/ucf/> and the Pennsylvania Urban & Community Forestry Council <http://www.pacomunityforests.com/>. Technical assistance and Emerald Ash Borer Management Plan template http://www.dcnr.state.pa.us/cs/groups/public/documents/document/dcnr_20028830.pdf provided through the Pennsylvania Department of Conservation & Natural Resources <http://www.dcnr.state.pa.us/>, Bureau of Forestry <http://www.dcnr.state.pa.us/forestry/index.aspx>