Emerald Ash Borer Management and Recommendations
City of Burlingame, Kansas

Introduction

A 100% inventory of ash trees along city streets and in city parks was conducted within the city limits of Burlingame, Kansas, on September 14, 2022. This inventory was conducted by Kim Bomberger, Kansas Forest Service and Burlingame tree board member, Chris DuBois. The ash trees inventoried were recorded as to their species, size and condition class, defined as:

GOOD: Healthy vigorous tree with no apparent signs of disease or mechanical injury. The tree is representative of its species and requires little or no corrective work.

FAIR: Tree of average condition and vigor for the area, with minor insect injury, disease or physiological problems. May lack desirable form characteristics of the species and may require some corrective pruning or repair.

POOR: Tree is in general state of decline, and may show severe mechanical, insect, or disease damage, but death is not imminent. May require major repair, renovation or replacement.

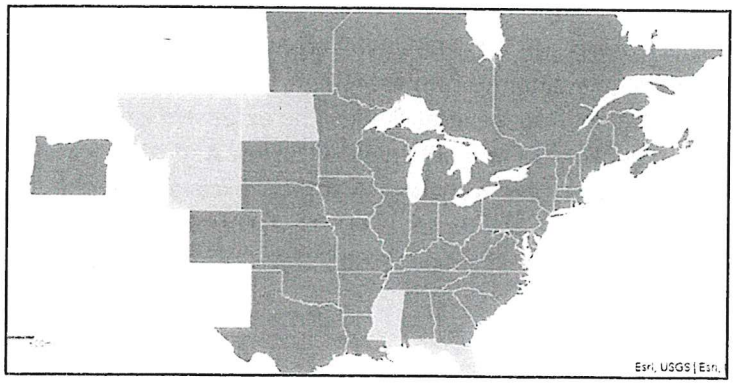
DEAD AND DYING: Dead or death imminent from drought, the emerald ash borer, disease or other causes.

**The data and map depicting ash locations was retained by Chris.

The purpose of this report is to provide information to the City of Burlingame to aid in the development of an emerald ash borer management plan. Ideally, an action plan will develop short and long-term strategies that address the potential for impact, preparation for an infestation, management of infested ash trees in the community, the planting of trees, and utilization of ash wood.

Background of the Pest

The emerald ash borer is an invasive pest that is native to Asia. The beetle was first discovered in North America in 2002 in the Detroit, Michigan area. Since that time, the insect has killed and caused the removal of hundreds of millions of ash trees in an attempt to reduce liability of dying trees and to slow its spread. Since its initial discovery, the core area affected by the beetle has expanded to 36 states and five providences in Canada. Ash is the primary species killed by the insect but with the emerald ash borer found in white fringetree in Ohio, it is not possible to rule out the insect moving to other species in the olive family to survive if its preferred host is not available.



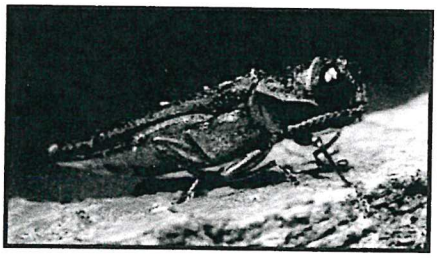
States with confirmed detections in dark green, as of September 2022. Map from www.emeraldashborer.info

On August 29, 2012, the first-ever presence of emerald ash borer in Kansas was confirmed at Wyandotte County Lake. The discovery was made by Kansas Department of Agriculture's Plant Protection and USDA's Animal and Plant Health Inspection Service's Plant Protection & Quarantine staff conducting a survey due to the July 2012 confirmation in Platte County, Missouri. Since that first detection in Wyandotte County, eleven other counties in Kansas have confirmed the insect's presence: Atchison, Brown, Doniphan, Douglas, Jackson, Jefferson, Johnson, Leavenworth, Miami, Osage, and Shawnee counties. While quarantine boundaries are no longer placed with new detections, actions should still be taken to:

- Not transport any life stage of the insect (adult, larvae or pupae)
- Not transport hardwood firewood
- Not transport *Fraxinus* (ash) nursery stock
- Not transport green lumber of the genus *Fraxinus*
- Not transport other material (living, dead or fallen), including logs, stumps, roots, branches, and composted and uncomposted chips of the genus *Fraxinus*

Identification and Lifecycle

There are many resources to identify the emerald ash borer online or in print. Detailed guides can be found at the national emerald ash borer website at http://www.emeraldashborer.info/identifyeab.cfm#sthash.M45CIM0J.kLa8UVhr.dpbs. Additional publications and materials are provided for distribution to city staff, tree board members, mayor and council representatives, and interested citizens.



Understanding the life cycle of the emerald ash borer will be necessary when considering chemical and other management decisions. ***It should be noted that the below is a guide and that actual temperatures (specifically the number of degree days) will influence when adults emerge and how the life cycle progresses each year.***

A general emerald ash borer lifecycle:

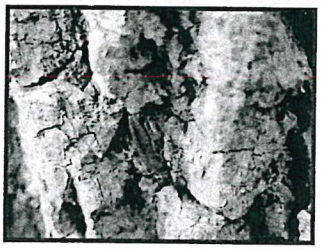
- ❑ In mid to late May, adults emerge from overwintering sites under bark to mate, with peak emergence mid to late June. Some sources indicate an emergence corresponding with the bloom of the black locust tree.
- ❑ Adults live three to six weeks.
- ❑ Yellowish eggs are laid in bark crevices two weeks after emergence. Eggs hatch in about ten days.
- ❑ Eggs transform to larvae. First instar larvae chew through bark and into cambial region.
- ❑ Larvae tunnel under bark to feed on phloem and outer sapwood for several weeks. The extensive galleries created by the larvae under the bark disrupt translocation of water and nutrients in the infested tree.
- ❑ Feeding continues through autumn and pre-pupal larvae overwinter in shallow chambers excavated in the outer sapwood or in the bark of thick-barked trees.
- ❑ Pupation begins late April to May. Newly enclosed adults often remain in pupal chamber for one to two weeks before emerging head-first through a 1/8th inch D-shaped exit hole.

Below are other images and descriptions. Source of most images below and additional information can be found at the USDA APHIS website at https://tinyurl.com/yc9zo2df

Exit holes may be found low on trunk.

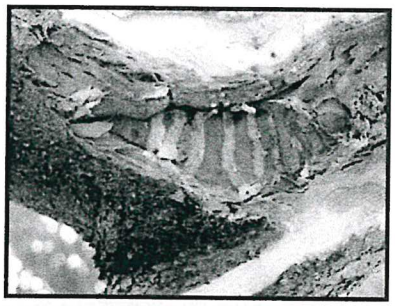
Bark may crack due to larval feeding damage.

Adults breed within 7 to 10 days. Females lay eggs that hatch in 7-9 days. Females mate several times.

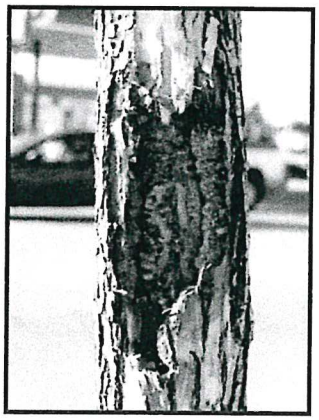


Females lay eggs in bark crevices, with an average of 77 eggs laid each time.

Larvae boring into sapwood.

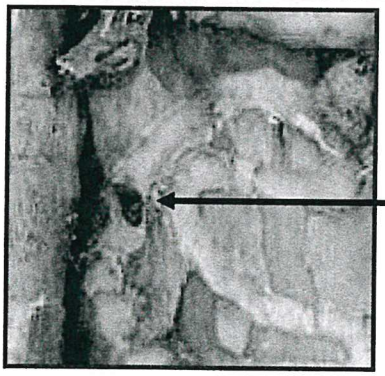


Larvae may bore at the bases of branches to hide from woodpecker feeding.

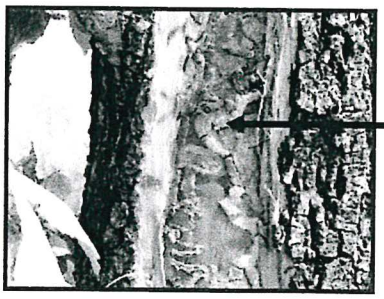


Heavy larval feeding.

Larvae pupate in galleries and emerge as adults. Note the s-shaped (serpentine) tunnels created by the feeding larvae.

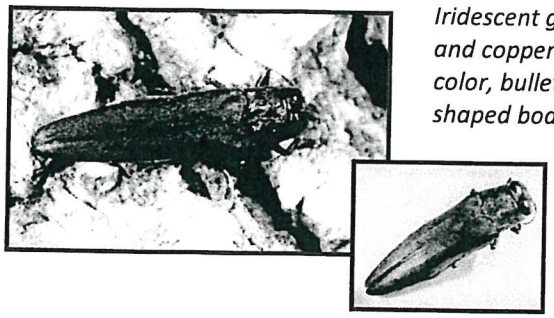


Adult emerging from a gallery.

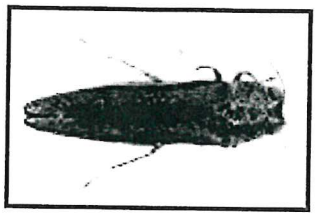


Frass-packed galleries.

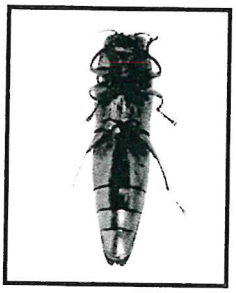
Adult emerald ash borer



Iridescent green and copper color, bullet-shaped body.

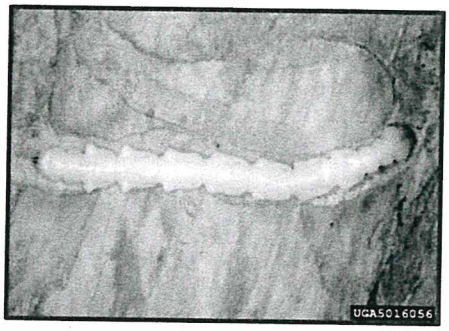


Dorsal view

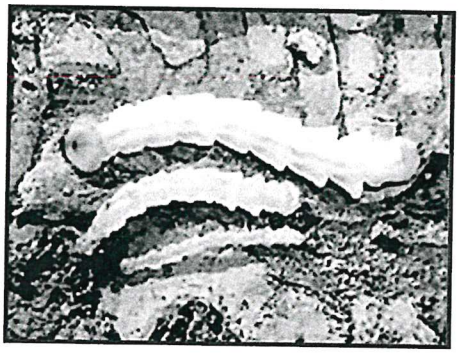


Ventral view

Larval emerald ash borer



White to cream-colored and legless. Flattened, bell-shaped body segments.



The terminal segment bears a pair of small appendages. Larvae grow in size before pupation.

Above: Second, third and fourth stage larvae.

Results of the September Ash Inventory

Data was collected on 28 green ash trees growing in the street right-of-way and parks in the city. A breakdown by condition class found 6 ash trees (21%) in fair condition, 19 (68%) ash in poor condition and 3 dead or dying trees (11%). These percentages can serve as a guide for the management needs of the ash. Good condition trees have no specific management concerns, fair condition trees usually require minor pruning, maintenance or insect and disease controls, and poor condition trees need more intensive management intervention. These condition classes can also be used to determine priorities for ash management by the city.

2022 Condition Classes by Percent

Value of the Green Infrastructure

It is important to understand that these ash and other trees in the community are infrastructure, just like the streets, sidewalks, stormwater systems, buildings and other gray infrastructure within the community. Ash and other trees provide many services to the community and environment. They add beauty and create an environment beneficial to our well-being by:

- Adding and defining natural character to our cities and towns.
- Providing us with colors, flowers, forms and textures.
- Screening undesirable views and softening the harsh lines of masonry, metal and glass.
- Reducing and cutting noise pollution by acting as sound barriers.
- Defining space and providing landscape interest and continuity.

Direct and measurable benefits of trees are also very significant. Properly selected and planted trees can:

- Reduce air pollution by trapping and holding particulate pollutants and absorbing carbon dioxide and other dangerous gases.
- Conserve water and reduce soil erosion.
- Reduce rainfall discharge to stormwater systems.
- Save energy by reducing glare and providing cooling shade in the sunny and hotter months and windbreaks during the cold winter months.
- Increase property values from 7% to 15%.

Trees are valuable to the City of Burlingame. The estimated value of the inventoried 28 ash trees is approximately $31,469. This value is computed using an equation developed by the International Shade Tree Conference which takes into consideration intrinsic values such as shade and beauty. But trees contribute more value than beauty and shade to a community; they are also work horses for community health and well-being. These ecosystem services can now be quantified by i-Tree Streets, a software program that provides community forestry analysis and benefits assessment tools. i-Tree Streets identifies ecosystem services such as energy conservation and savings, air quality improvement, carbon dioxide reduction, stormwater runoff reduction, aesthetic and other economic benefits. This data can be incorporated into stormwater and air quality programs and strategies, to build support for community tree planting and care and in community sustainability and conservation programs.

As ash trees are removed from Burlingame's streets and parks, the services and benefits of these trees will be lost. These losses are permanent if these trees are not replaced. If new trees are planted now, the many benefits that the public tree resource provides will be lost for a shorter time. All tree planting should be matched with a corresponding maintenance and pruning program to grow young trees to mature sizes that yield the greatest benefits to the community.

To calculate ecosystem services and value, the ash data was imported into the i-Tree Streets program. It should be recognized that the enclosed reports reveal only the ***total value*** of the ecosystem benefits provided by these trees, not the net value that could be calculated using local tree maintenance costs.

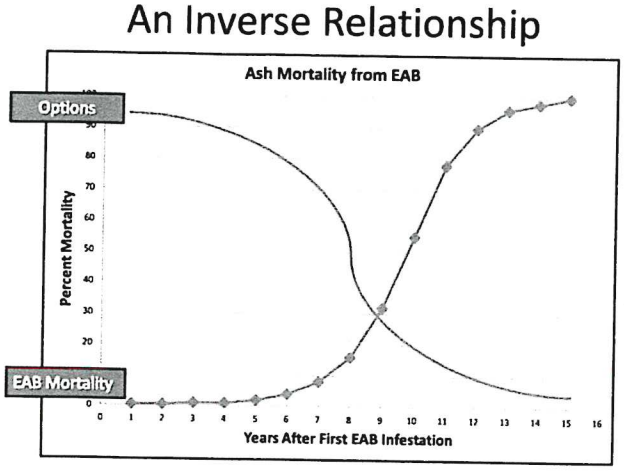
Highlights of the enclosed i-Tree Streets reports revealed the following *total **annual** benefits of these ash trees:*

Ecosystem Service	Resource Unit Quantity	Value of Ecosystem Service
Energy conservation	3.3 MWh, 102 Therms	$321
Carbon dioxide sequestration	10,735 net pounds	$35 net value
CO^2 emissions avoided	7,133 pounds	$24
Air pollutant absorption	97.9 pounds	$110
Air pollutant emissions avoided	56.3 pounds	$72
Stormwater reduced flow	142,046 gallons	$881
Aesthetic and other benefits		$705
Total Yearly Benefits		**$2,052**

While not an annual benefit, the ash tree resource also stores a considerable amount of carbon – 298,568 pounds - with a calculated ecosystem benefit of **$985.**

Please refer to the enclosed i-Tree reports for specific information and values. The *Lower Midwest Community Tree Guide*, a publication of the USDA Forest Service, is helpful in understanding these ecosystem services and how trees positively impact people's lives and community health. That publication may be found online at https://www.itreetools.org/documents/447/PSW_GTR219_Lower_Midwest_CTG.pdf

Potential Ash Mortality



With the emerald ash borer now found in Osage County, the Ash Mortality Curve to the left shows how the population is likely to increase once it becomes established in the area. It is important to realize the exponential loss that will occur once a population of the emerald ash borer builds within a city's boundaries. Note that in the early years of an infestation, the population does not rise significantly. But when the population reaches the levels indicated for years 5 and 6, the death of ash trees rises significantly and then dramatically thereafter. The options for ash management directly correlate with the level of infestation. In the early years of infestation, more management options are available but then decrease as the infestation builds and spreads throughout a community.

Treatment Considerations

How the city plans for and makes its priorities for management may depend on several factors. Some basic decisions that should be made now are if every ash tree on public property will be treated to prevent infestation, if no ash trees will be treated on public property or a mix of the two is the better option. Most cities in Kansas are electing to remove their poorest condition ash trees first. Two primary reasons drive this philosophy: 1) a difficulty to justify investment in trees that have defects, reduced canopy sizes, or other health or structural problems, and 2) to reduce the population of ash currently on public property so that the cost and management burden is less once an infestation builds within the community. If chemical treatment is considered, below are two resources that provide detailed information:

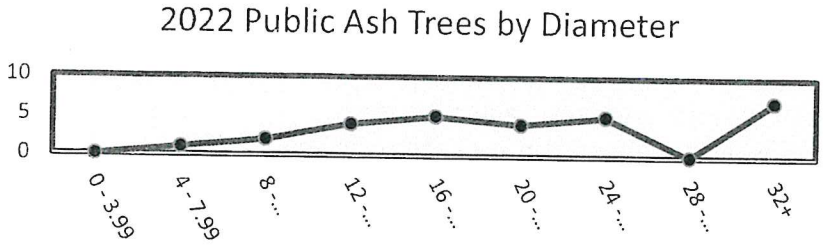
- North Central IPM Center. *Insecticide Options for Protecting Ash Trees from Emerald Ash Borer, 3rd* Edition. Found online at http://www.emeraldashborer.info/files/multistate_EAB_Insecticide_Fact_Sheet.pdf
- *Frequently Asked Questions Regarding Potential Side Effects of Systemic Insecticides Used to Control Emerald Ash Borer.* Found online at http://www.emeraldashborer.info/documents/Potential_Side_Effects_of_EAB_Insecticides_FAQ.pdf

Prioritization of Efforts

If resources are limited and choices must be made for where in the city to allocate resources, the USDA Forest Service, Northeast Area, offers the publication *Urban Tree Risk Management: A Community Guide to Program Design and Implementation* that provides guidance on how to design a risk management plan within the overall emerald ash borer action plan. *Dying ash trees on both public and private properties will present hazards and risk situations that cannot be ignored by the municipality. Future risk potential should be discussed now.* Chapter 1 in the publication introduces the topic of risk management, while Chapter 2 discusses how to plan and design a risk management program. The risk model that begins on page 24 in Table 2.1, could be helpful in designating risk categories and risk zones in the community. The publication may be found at https://www.fs.usda.gov/treesearch/pubs/11070

Planting and Establishment of New Trees

The loss of ash trees and the subsequent loss of the community canopy will have negative environmental, economic and social impact to the City of Burlingame. Fifty-seven percent (57%) of the inventoried population (16 trees) are 20" and larger in diameter, nearing or at a mature size. These trees are providing higher levels of ecosystem services and other benefits to the city and its residents. The graph, at left, categorizes the size of the trees by diameter range. Note that 7 ash trees are 32" and larger and within that population, 6 are poor and 1 dead or dying. Those trees alone will need significant management attention. It is recommended that a multi-year planting and corresponding maintenance program be developed now in preparation for the loss of tree canopy.



There are many species of trees suitable for Burlingame; several that the general public may not be aware of. The document *Preferred Trees for Northeast Kansas,* https://tinyurl.com/y9k9ub86, encourages a diverse array of trees for planting in Northeast Kansas. It offers landscape attributes and site tolerances of listed trees as well. Uncommon or lesser-known trees are encouraged but should be thoroughly researched and matched to the site conditions, then planted in small quantities until it is known that the tree is appropriate for broader planting in the community. *Species such as red and silver maple, hybrids of them (Acer x freemanii), pin oak, ornamental and Bradford pears and other over-used trees should be discouraged in future public plantings.*

Debris Removal and Utilization

Another significant decision that should be made ahead of a full-blown emerald ash borer infestation is where ash debris from public property will be staged or disposed of and how to educate and advise your local citizenry about handling their infested ash trees. It is extremely important that private individuals and commercial entities working within Burlingame understand the perils of moving firewood, raw ash materials and the potential for spreading the insect itself. The Kansas Forest Service website has information that may be used for reference and education at https://www.kansasforests.org/forest_health/current_pests/emeraldashborer.html

An aspect of utilizing community trees that is often overlooked is the storage of carbon that is held in the wood and tissues of trees. When trees are removed, and their wood not utilized, that storage benefit is lost. But if useable public trees are milled and made into park benches, tables, furniture and other products, much of the 298,568 pounds of carbon being stored in these trees can be retained. Think of this as a direct contribution to improving your community's health because asthma exacerbation, lost work and school days, visits to the hospital and emergency room, and acute respiratory symptoms, for example, are reduced.

Commendations

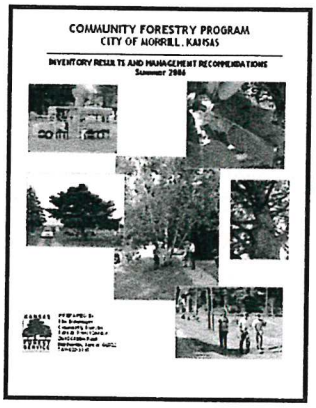
I commend the city and tree board for looking and working ahead of an emerald ash borer infestation in your city. The collection of data and the development of an emerald ash borer management plan is a good first step to identifying how the city will respond to the emerald ash borer's presence within Burlingame's boundaries. With the insect detected in Osage County, now is the time to get a plan in place and enact components that can be completed ahead of an infestation. The data above can guide those decisions.

Take Action Now

There are many steps that can and should be taken now to prepare the city and citizens of Burlingame for an infestation of emerald ash borer. *The following is offered to help recognize what those actions could be but may not encompass all that the city should consider.*

Preparation for the Emerald Ash Borer

- ❑ Develop a community response and communications plan. See Appendix A of the Kansas EAB Response Plan and other resources provided.
- ❑ Institute a branch sampling procedure when ash trees are pruned and removed.
- ❑ Require contract arborists to branch sample when ash trees are pruned and removed.
- ❑ Understand the potential for loss
  - ✓ Identify how many ash are in your city and where they are located. Use current inventory data or conduct inventory just for ash.
    - ➢ Estimate private property ash trees by numbers or percentage of urban tree canopy.
  - ▪ Is there interest to assess ash populations on private property?



- ❑ Reduce the potential for loss. Enact an ash reduction plan
  - ▪ Remove ash trees in poor condition.
  - ▪ Remove the youngest and replant with other species.
  - ▪ Remove ash in poor locations.
  - ▪ Inventory and inspect good and fair condition ash populations regularly.
- ❑ Communicate with city leadership and staff in all departments
  - ▪ Relay knowledge of current risk.
  - ▪ Relay potential loss – environmental, economic and social.
  - ▪ Relay estimates of future costs: removals, stump grinding, planting and establishment, risks/public safety.
  - ▪ Project budgetary impact.
- ❑ Staff /Tree Board Training
  - ▪ Identification of trees, especially ash.
  - ▪ Identification of the emerald ash borer and how it spreads.
  - ▪ Learn branch sampling method.
  - ▪ Review tree ordinances and authorities.
- ❑ Communicate with Your Public
  - ▪ Conduct seminars within your community - communicate the potential loss.
  - ▪ *Emphasize the importance of trees to your community!*
  - ▪ Regularly share information with local newsprint, television, radio and other media outlets.
  - ▪ Encourage an EAB News Section on the main page of the city's website and the tree board webpage.
  - ▪ Teach your residents how to identify ash and the emerald ash borer.
  - ▪ Provide pest alerts and other appropriate publications during Arbor Day or other outreach event.
  - ▪ Understand chemical options and be able to explain when they are or are not appropriate.
  - ▪ Communicate the problems with transporting firewood or using non-local sources.
  - ▪ Encourage planting and species diversity on private properties.
  - ▪ Educate about the importance of tree planting and establishment, proper selection, placement and post-planting care.
- ❑ Develop partnerships with green industry and businesses
  - ▪ Utility providers
  - ▪ Nurseries/growers
  - ▪ Commercial arborists
  - ▪ Wood disposal sites in county or those commercially owned
  - ▪ Wood utilization companies or sole proprietor businesses that utilize wood
  - ▪ Architects and landscape architects.
  - ▪ Building contractors and developers (wood use, planting). Residential or commercial entities.

As noted above, communication to the community can be complex and take various forms. Simple or more detailed messages may be developed for various audiences but should always be formulated from the best science and facts known at the time. The national emerald ash borer website, http://emeraldashborer.info, offers a wealth of information that is updated over time. Another online source that may be helpful to residents is the *Managing Emerald Ash Borer: Decision Guide* from Indiana:
http://extension.entm.purdue.edu/eab/pdf/NABB_DecisionGuide.pdf.
The below bullets are offered to guide the development of brief community messaging.

Emerald Ash Borer Basic Messages

- Emerald ash borer (EAB) has been detected in Atchison, Brown, Doniphan, Douglas, Jackson, Jefferson, Johnson, Leavenworth, Miami, Osage, Shawnee and Wyandotte counties in Kansas.
- It kills all species of ash trees (*Fraxinus* species) that are native to North America.
- EAB was first detected in southeastern Michigan. It has now spread to 36 states and 5 Canadian provinces.
- To prevent the spread of the EAB to other communities and counties, do not transport nursery stock of the genus *Fraxinus*, green lumber of the genus *Fraxinus,* all hardwood firewood, any life stage of the insect, and other material living, dead, cut or fallen of the genus *Fraxinus*.
- Kansas Department of Agriculture and Kansas Forest Service annually monitor for the pest.
- People can learn how to identify ash trees at many websites. For example, at http://www.youtube.com/watch?v=wXCynbvf4Lc.
- Information about EAB and/or ash identification may also be obtained from county extension offices, the Kansas Forest Service, Kansas Department of Agriculture and www.emeraldashborer.info
- The planting of ash trees is discouraged.
- If a tree is displaying symptoms of the emerald ash borer and it is outside of a known infested county, contact the Kansas Department of Agriculture at 785-564-6698.

Summary

Emerald ash borer is an exotic and invasive insect that is present in Kansas. The potential loss of ash trees in the national urban landscape is estimated between a half percent to two percent of the total leaf area (30 to 90 million trees) and a lost asset between $20 to $60 billion. The landscape value of Burlingame's ash trees is $31,469 and the value of their ecosystem services is estimated at $2,052 per year. The city's stormwater system could see an increased flow of 142,046 gallons per year as ash trees are lost and removed. Utilizing as many ash logs as possible will help retain much of the 298,568 pounds of carbon currently stored by the inventoried ash trees. Fortunately, data now exists to understand the risk of loss to the city's ash resource and to help create an ash management plan. The data collected on public properties shows that 28 ash trees are at risk of infestation with 21% ash in fair condition, 68% in poor condition and 11% dead or dying. Trees provide tangible benefits and a documented value to the community - services and values in the thousands of dollars. The enclosed data and recommendations here can be used to develop short and long-term strategies to manage the ash tree resource in Burlingame. With the emerald ash borer in Osage County, now is the time to act.

KANSAS FOREST SERVICE
KANSAS STATE UNIVERSITY

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