Tree Campus USA—2018

I, Cathie Lavis, am pleased to submit our Tree Campus USA recertification package on behalf of Kansas State University, Manhattan, KS. Kansas State University is honored to be a recognized and designated Tree Campus USA college since 2013.

Arboriculture students, Spring 2018 semester Arbor Day educating the campus community about the eminent arrival of Emerald Ash Borer. Kansas State has over 250 ash trees on our campus.

Arboriculture students planting a tree in honor of Provost Mason. Arbor Day, 2018.

Background: Kansas State University, as it is known today, began in 1858 as Bluemont College (Willard, 1940). Bluemont College was established as the first land-grant college by the provisions of the Morrill Act. As a result, it was renamed, Kansas State Agricultural College in 1863.

Anderson Hall—the administration building, 1885

The current location of the main campus was originally three farmsteads, housing only a few trees. Specifically, a Kentucky coffee tree, *Gymnocladus dioicus* and an Eastern Red Cedar, *Juniperus virginiana* that were located to the northwest of Anderson Hall, which was built in 1879, one of the oldest buildings on campus. In the western boundary of the northeastern campus stood two large thornless honeylocust, *Gleditsia triacanthos*. Today, one still stands in what is now known as the quadrangle surrounded by Hale Library, Waters Hall, Leasure Hall and Willard Hall. These two honeylocust marked the fence line on Reverend Gales' property. Reverend Gale operated a nursery, selling thousands of trees to Kansas residents. Being an experienced plant person, Gale became the first superintendent of the Department of Horticulture. His nursery facilitated both teaching and research objectives. During Reverend Gale's tenure, 1870-1879, newly introduced trees to Kansas were put on trial on the campus grounds. Approximately 100 species of trees and shrubs were sent from Harvard Botanical Gardens to determine how well they could withstand the Kansas landscape (Willard, 1940). Students helped plant, prune and graft the plant materials. In addition, with Gale's foresight, shelterbelts and evergreens were planted and transplanted between 1881 and 1887. The large, old Austrian pine, *Pinus nigra*, just north of the clock triangle on the main campus corridor was one of these transplants as a frozen ball. The historic green ash, *Fraxinus pennsylvanica* located in the quad was also part of the shelterbelt.

Today it is hard to image that our beautiful treed campus had only a few trees except for the occasional cottonwood (*Populus deltoids*) and boxelder (*Acer negundo*) in addition to the tree already mentioned when the college began in 1863. In 1879, David Fairchild in his book, "The World Was My Garden," Dr. Fairchild

compared our campus to a “cheerless, treeless wasteland,” a telling remark from the famous worldwide plant collector.

So it is with this rich history of how our campus grew from a treeless site to the arboretum it is today depends upon the continual planting, care and respect we have for our trees that led our mission— *establishing our campus as a recognized Tree Campus USA in 2013.*

At the beginning of the spring 2013 semester, students in HORT 585: Arboriculture realized the potential of becoming a recognized Tree Campus USA (a partnership of Arbor Day Foundation and Toyota) as proposed by Dr. Lavis. Students learned that this program recognizes campuses that effectively manage and care for their campus trees by meeting five standards that promote healthy trees and student involvement. In addition, to this key objective, Tree Campus USA helps develop connectivity within the campus as well as the community at large by engaging students with service learning opportunities.

It is with great pride we continue honoring our trees. During 2017 spring semester, the arboriculture class of 45 students enthusiastically organized the Arbor Day (Standard 4) and Student Learning Project (Standard 5). The Tree Campus USA committee is comprised of people from facility management, faculty and community members; these members were involved as well, particularly with Standards 2 and 3.

Standard 1: Campus Tree Advisory Committee—2018

The committee includes a representative from each of the following audiences:

Student Project Chairs: Caitlynn Carlson, Senior—Horticulture
Students Assisting with the Project Coordination: Katherine Doll—Horticulture and Allison Dix—Ag Education

Faculty —

- Kim Bomberger: Associate Community Forester, Kansas Forest Service (kbomberger@ksu.edu)
- Dr. Ray Cloyd: Ornamental Entomology & Integrated Pest Management (rcloyd@ksu.edu)
- Dr. Cathie Lavis: Professor and Extension Specialist, Department of Horticulture and Natural Resources (clavis@ksu.edu)
- Scott McElwain: Director, Kansas State University Gardens (mcelwain@ksu.edu)
- Judy O’Mara: Instructor/Diagnostician, Department of Plant Pathology (jomara@ksu.edu)
- Lee Skabelund: Department of Landscape Architecture/ Regional & Community Planning (lskab@ksu.edu)

Facility Management—

- Joe Myers: Physical Plant Supervisor & Facilities Grounds Manager (okia@ksu.edu)
- Ryan Swanson: University Architect (rswanson@ksu.edu)

- Mark Taussig: Campus Landscape Architect, Associate Director Campus Planning & Facilities Management (taus@ksu.edu)

Community —

- Randy James: Arborist/Owner, Growing Concerns, Manhattan, KS (rjplanthealth@yahoo.com)
- J David Mattox: Forestry Supervisor, City of Manhattan, KS (mattox@cityofmhk.com)

Date of committee establishment: January 2013

Meeting dates for the 2018 year: January, March, June

Standard 2: Campus Tree Care Plan

1. Clearly stated purpose. (Written by Matthew McKernan, undergraduate horticulture student as a class assignment in Arboriculture class, Spring 2013; May, 2015 graduate: Landscape Design. Matt is currently employed as the Sedgwick County Extension Agent, KS).

- A well-maintained university landscape creates a sense of belonging, safety, comfort and beauty in the campus environment. Trees are the focal point of the landscaping and have tremendous impact on the image of our campus, creating a long-lasting impression in the eyes of students, their families, employees and visitors.
- Our goal is to maintain our campus trees by promoting wise health care practices that include rotational pruning schedules and necessary removals while incorporating new plantings that will enhance and improve the campus at present and for future generations.
- To continue to facilitate our campus as an outdoor learning laboratory for students.

This goal is being accomplished by achieving the following:

- Facilitate the achievement from 25% to a 35% tree canopy on our campus as recommended in the 2012 Kansas State University Landscape Master Plan. This will be accomplished by planting new trees for enjoyment on our campus life and for learning purposes.
- Facilitate the achievements of doubling existing woodland coverage on campus as recommended in the 2012 Kansas State University Landscape Master Plan.
- Protect and maintain campus trees by managing the impact of development and construction on the campus grounds.

2. Responsible authority/department:

- The care of our campus trees rests with the Kansas State University Division of Grounds Maintenance and the Housing and Dining Grounds Maintenance Department.

3. A Campus Tree Advisory Committee, terms of the representatives, and role committee plays.

- The committee members serve for a period of one calendar year with a renewal option. Officials will be appointed by members to conduct the day-to-day business of the committee.
- Committee members are expected to actively participate and contribute in policy/guideline issues as well as research/information gathering in regards to trees and their care.

4. Campus tree care policies for selection, planting, establishment, maintenance, pruning and removal as well as managing catastrophic events.

- Kansas State University Tree Care Policy recognizes that if trees are to be healthy and long lasting they must be selected for the site, planted correctly, and that aftercare is critical to success.
- Landscaping on the Kansas State University campus must adhere to the ten landscape typologies according to 2012 Campus Master Plan.
- These ten areas are edges and entrances, quadrangles, pedestrian malls, plazas, courtyards, campus green space, woodland habitats and riparian corridors, playing fields, agricultural research lands, and surface parking. The best plant materials for each typology shall be chosen based on site conditions and use.
- Kansas State University strives to uphold the highest standards for trees and their care on our campus with the limited funds available. Our campus will subscribe to the ANSI standards to provide for or supervise the management of trees, shrubs, and other woody landscape plants. ANSI A300 standards are the accepted industry standards for tree care practices. ANSI A300 Standards are divided into multiple parts, each focusing on a specific aspect of woody plant management.

Tree Selection and Planting Recommendations

Evaluation of the Site

- The specific planting site should be evaluated closely as it is essential to understand how the chemical, biological and physical aspects of the soil environment interrelate and function. Many trees fail because site characteristics are either improperly evaluated or ignored. Both above ground and below ground aspects should be closely considered.
- Because selecting the right tree for the site is critical, K-State utilizes the following, "Site Evaluation Guide" (Gilman, 1997). Appendix 1.

Tree Selection

- Trees should be purchased from a reputable grower who complies with the American Nursery Standards for Nursery Stock (ANSI Z60.1-2014).
- Plants should be selected to enhance the beauty of the campus as well as supporting a sustainable landscape. Selecting native, low-maintenance plants is preferred, however, there will be occasions for selecting non-native plant material to expand diversity and educational benefits. The campus is used as a teaching laboratory, therefore, increasing the diversity of species is valuable to our mission as a land grant university.
- Trees will be selected per the "Site Evaluation Guide," based on adaptability to physical site conditions, and serviceability while meeting planting needs based on site orientation, drainage, soil conditions, salt and drought tolerance, pest susceptibility, mature size, growth rate, longevity and ornamental character.
- Selection should also consider tree care requirements after planting.
- Plant species used on Kansas State University campus will be thoughtfully selected following K-State Extension recommendations, such as, *Shade and Ornamental Trees for Kansas, Trees* and *Shrubs for Difficult Sites* and other reputable sources such as, Gilman, (1997) and Dirr (2009).
- Trees may be root ball stock either balled and burlap (B&B), container or bare root plants. Trees produced by all nursery methods should meet certain basic quality standards, some growers not only met the industry standards but exceed them, these growers should be used when possible.
- Initial tree size will be dictated by the specific location and availability. Size should not be the determining factor for selection as research shows that large trees are slower to establish while smaller caliper will establish more rapidly. Primarily trees of 1-2 ½ inch caliper will be planted with a maximum of 4- 4 ½ inch caliper.
- Plants shall be sound, healthy, vigorous, free from plant disease, insect pests or their eggs and shall have balanced, healthy, normal root systems.

Planting

- Planting trees shall follow ANSI A300 (Part 6)-2012 Planting and Transplanting.
- Site soil management and preparation should follow ANSI A300 (Part 2) - 2011 *Soil Management a. Modification, b. Fertilization, and c. Drainage*
- The planting hole should be wider than the root ball; two-three times is ideal (Watson and Himelick, 2013). The sides shall slope gradually, making the hole saucer-shaped. The more compact the soil, the larger the planting hole should be to support initial root growth.
- The planting hole should be dug sufficiently deep to accommodate the root ball, yet the ball should sit on undisturbed soil to prevent settling.

- When placed into the planting hole, the top of root ball should be at or slightly above the surrounding the existing soil grade. Stem girdling roots have been associated with several species because of planting too deeply (Watson and Himelick, 2013).
- Once the plant is properly placed, remove all visible rope and burlap from the top one-third of the root ball. The top 8-16 inches of the wire basket should be removed once the rootball is stable in the planting hole.
- Water the rootball *prior* to placing any backfill into the planting hole, once water has been absorbed into rootball and surrounding soil, *backfill the planting hole with the soil that came out of the planting hole*.
- As the backfill soil is placed back into the hole, tamp with the tool handle to firm the soil to remove large air pockets, but **not** too firmly or aggressively as to remove all fine air spaces needed for a well-aerated soil for root development. Complete the backfill by making sure that the trunk flare is completely exposed.
- Spread mulch at a 2-4-inch depth depending upon soil texture, less for heavier clay soils. Do not place against the trunk in a volcano-type manner. Water the rootball and the planting area a final time.
- Newly planted trees must receive adequate water weekly during the entire first growing season right up until dormancy in the fall, by irrigation or placement of ooze bag or hand watering. If the winter months are dry, watering fall planted trees is highly recommended.
- Fertilization at planting is not recommended; research shows fertilization is not effective until the root system has established into the surrounding soil.

Pruning

- At planting, remove damaged, crossing and codominant stems or double-leaders. If possible, do not allow more than one branch to originate at the same location. Do not over prune at planting; trees need foliage to grow roots.
- Work procedures will follow the requirements (indicated by the word "shall") and recommendations (indicated by the word "should") of the ANSI A300-2017: Part 1 Pruning Standards.
- On occasion, the arborist is allowed to deviate from a recommendation based on the unique needs of a particular job, tree species, or work site.

Staking

- The tree should only be staked when stability is an issue. If staking is necessary, it should be done according to ANSI A300 (Part 3) -2013 *Supplemental Support Systems* (includes Cabling, Bracing, Guying, and Propping) recommendations.
- Care must be taken to avoid staking too rigidly or allowing damage to occur to the bark or stem. Once new roots have established and the tree is stabilized, all staking materials must be removed, typically one full growing season.

Trunk Protection

- Trees with thin bark can be damaged by a warm winter sun and should be protected. Standard paper wrap should be applied from bottom up so that it overlaps like shingles. Wrap in late fall, remove by late April.
- Protect main stem as needed with wire mesh from rabbits, mice or beavers.

Preventative Maintenance Pruning: During all tree care practices the ANSI Z133.1-2017: *Safety Standards for the Tree Care Industry,* are followed. The K-State Facilities tree team systematically prunes trees annually through a preventive maintenance-pruning program. Preventive maintenance pruning is conducted using the ANSI A300-2017: Part 1 *Pruning Standards.*

- **Normal pruning schedule**:
    - Trees less than 5 years old: Receive structural pruning on an annual or biennial basis. Leave only one leading stem, and remove branches greater than ½ the diameter of the trunk; however, do not remove more than 1/3 of the live foliage at any one pruning visit.
    - Trees 5-10 years old: Receive structural pruning every two to five years. Remove competing branches, and reduce all branches greater than ½ the diameter of the trunk. Select the lowest permanent limb and remove branches lower than this.
    - Trees 10-20 years old: Receive structural pruning every five years. Identify 5-10 permanent scaffold limbs, and reduce clustered branches. Remove competing branches.
    - Trees older than 30 years old: Receive maintenance pruning every five to seven years. Clean dead, diseased, dying and defective branches from the crown.

Service Requests

- The Kansas State University Grounds Maintenance Departments typically prunes over 100 trees annually as needed or by service request. Campus community members around campus including police, parking service, maintenance service, etc. make requests.
- Requests are followed up by an inspection of the trees by the staff arborist who generates the evaluation and tree rating to determine the type of pruning to be performed by staff. Routine inspections by staff provide most of the pruning needs.

Fallen Limb Removal

- When tree limbs fall on campus, debris is promptly removed. Facilities Grounds is notified by staff inspection, community member calls, and/or service requests.
- Depending on the storm severity, along with priority of debris clean up, every attempt will be made to remove debris within the same day.
- Private properties adjacent to the Kansas State University campus are not maintained by the university.

Hazard and Emergency Tree Removal

- Managing risk for campus trees is critical, the ANSI A300 (Part 9) - 2017 Tree Risk Assessment should be used to define appropriate methods and work plans for getting this work done.
- From 2010-2017, over one hundred trees were removed annually, many due to age or construction.
- When a tree removal request is made, several tree care specialists evaluate the tree in question and make the determination for removal or not. If the tree is considered a hazardous tree, it is then scheduled for removal.
- All hazardous trees have two things in common: a significant defect and a potential for falling on a building, cars or pedestrians. Tree removals are done by staff or contractors. Very large trees needing a crane are contracted out.

Stump Grinding

- After trees are removed, stumps are ground out, provided there is adequate access to the site.
- After the stump is ground out, the grindings will be raked and left slightly mounded to allow for decay and settling to occur.

Managing for Catastrophic Events

- In the event of severe weather conditions such as tornadoes or winter storms, falling trees will be removed by Kansas State facilities staff or an outside tree removal company. The order of removal will be as follows: campus roads and streets, followed by access to buildings deemed critical, including administrative buildings, housing, critical labs, libraries, and Student Union. When possible, all necessary equipment shall be checked for preparedness and safety by staff when advance knowledge of

severe weather conditions is available.

5. Protection and Preservation policies and procedures — include process for implementing tree protection plan including step-by-step process that every project must follow including construction and trenching.

Protection and Preservation Policies and Procedures

- Prior to any construction tree protection zones will be established and maintained for all trees, in order to protect and reduce damage to trunk and root systems from equipment and storage under tree canopies, and fill/excavations according to the ANSI A300 (Part 5)-2012 *Management of Trees and Shrubs During Site Planning, Site Development, and Construction*
- This protection zone for each tree or grouping shall consist of chain link 6' high fencing. Install the barrier fence based on the tree canopy. *When limited by existing pavements, set barrier fence along existing pavement edge* and in no case shall the protection zone be less than a radius of 2.5 feet. Protection to the drip zone is preferred in all situations possible.
- Root raking will not be permitted within any tree protection zone at any time during the construction project, including clearing and grading phases.
- Equipment and/or vehicle parking or storage of construction material and pouring or disposing of substances will be prohibited within any tree protection zone at any time during a construction project. IF VECHILES ARE FOUND PARKED IN TREE ZONES, A PARKING VIOLATION IN MINIMUM OF $50.00 will be issued to the contractor by K-State Parking, this fine is per vehicle in violation.
- To the extent possible, all site work shall be planned and conducted in a manner that will minimize damage to protected trees from environmental changes such as altered site drainage or any other land disturbance within or immediately adjacent to the critical root zone of the tree.

New Building or Facilities Construction

- Development activities shall be planned to the extent possible in order to preserve and protect trees on K-State Campus. *Any tree* on the K-State campus that must be removed to accommodate development, including utility installation apply *must be shown on the site plan and a method of compensation shall be from one of the following as deemed appropriated by campus facilities and the Tree Campus USA board members:*

  a) Replacement cost will be based on a 2.5-3" caliper tree of the same or similar species and labor to install. Trees that are damaged or removed with a caliper of greater than 4" in caliper typically do not have replacement trees of the same size, so use (b) to determine compensation.

  b) The sum total of the diameter of replacement trees (inches) shall be multiplied by that year's actual cost of the tree market value. For example: replacement cost for a 3" caliper tree plus labor to install according to local, reputable landscape nurseries will be used to determine total compensation.

  c) New construction projects shall pay for replacement or transplanting of memorial plants within construction site. Replacement cost will be based on 2.5- 3" caliper trees and labor to install.

  d) An account called Campus Beautification account was created to receive and manage the tree replacement program. This allows for the flexibility of planting time in case of the site is not ready or if the site has insufficient space for tree at the time.

  e) Total loss of a tree or trees that are too large to be replaced resulting in removal shall be paid for by the contractor into the Campus Beautification account according to the guidelines in (b) above.

Design Requirements

- Landscape plans shall be required for new developments and/or reconstruction project proposals. Proposed plans should include tree protection, and landscape and irrigation (if needed) plan information. Additionally, design plans will conform to the landscape standards as prescribed in the 2012 Campus

Landscape Master Plan.

6. Goals and Targets — develop at least one goal and target for your Campus Tree Plan. These could include (but are not limited to) tree canopy target, development of a link between the Campus Tree Plan and other green initiatives on campus or in the community; completion of a campus-wide tree inventory, etc. Include how the goal will be measured.

Goals and Targets

- Develop an integrated, ecologically based landscape and open space system that will help Kansas State University achieve its goal of environmental sustainability by:
    1. Increasing campus tree canopy to a minimum of 35%.
    2. Doubling the exiting woodland coverage.
    3. Completion of an updated Campus Tree Inventory. A GIS Tree Inventory is in progress to update the Campus Tree Inventory. The GIS inventory will be placed on a web based server, allowing campus landscape architects, forestry professors, and campus arborists to update in a quick and cooperate way during planning and management. Academic exercises and public use will be given read-only access.
    4. During the summer 2017 most of the ash trees, over 250, were inventoried in preparation for our strategic planning of the Emerald Ash Borer (EAB). EAB is now located within a 60 mile radius of Manhattan, KS or Riley County.

7. Tree damage assessment — enforcement, penalties, and appeals.

- All damaged trees on Kansas State University campus shall be assessed by Campus Landscape Architect and/or a certified Arborist. Whenever the damage has occurred, the Facilities representative or project manager shall immediately issue written and oral notice to the person or company in violation, identifying the nature and location of the violation and specifying that remedial action is necessary to bring the violation into compliance. The person or company in violation shall complete the remedial actions as specified in the notice. Project manager shall enforce the protection measures.

8. Prohibited practices.

- Under no condition shall a tree be planted on Kansas State University campus for dedication without pre-approval from the office of Campus Planning and Facilities Management Department.

9. Definitions of terminology related to campus trees.

Abatement: Reduction in hazard, either by treatment of tree or removal of target.

Abiotic disorder: Plant problems caused by non-living agents.

Absorbing roots: Fine, fibrous roots that take up water and minerals; most are located within the top 12 inches of the soil.

ANSI A300: The industry developed standards of practice for tree care.

ANSI Z133.1: Safety standards for the tree care industry.

Backfill: Soil put back into the planting hole, does not include addition of any amendments.

Biotic disorder: Problem caused by living organism.

Bleeding: Flow from sap from wounds and/or other injuries, may be accompanied by foul odor.

Branch bark ridge (BBR): Top area of a tree's crotch where the growth and development of the two adjoining limbs push the bark into a ridge. A good location to guide proper branch/stem removal.

Branch collar: Area where a branch joins another branch or trunk created by the overlapping xylem tissue. A pruning cut should be made to the outside of the collar without damaging this area.

Branch protection zone: Tissues inside the trunk or parent branch at the base of the subordinate branch that protect against the spread of decay.

Burl: Swelling on the main stem or branch; not considered a defect.

Caliper: The diameter or thickness of the main stem of a young tree or sapling as measured at six (6") inches above ground level. This measurement is used for nursery-grown trees having a diameter of four inches or less. If diameter is greater than four inches at six inches up from the ground, measure caliper at 12 inches.

Cambium: Layer of meristematic cells that give rise to the phloem and xylem and allow for the diameter increase in a tree.

Canker: A localized area of dead tissue on a stem or branch, caused by fungal or bacterial organisms, characterized by callus development on the periphery.

Canopy trees: A tree that will grow to a mature height of at least 40 feet with a spread of at least 30 feet.

Cavity: An open wound, characterized by the presence of extensive decay and resulting in a hollow.

Chlorosis: Whitish or yellowish discoloration caused by lack of chlorophyll; a primary symptom of high pH soils.

Clearing: The removal of trees or other vegetation of two inches DBH or greater.

Codominant stems: Forked stems of the same size in diameter and lacking a normal branch union.

Compartmentalization: Natural process of defense in trees by which they wall off decay in the wood.

Cracks: Tree defects that, if severe, may pose a risk of tree or branch failure.

Critical root zone: The minimum area surrounding a tree that is considered essential to support the viability of the tree and is equal to a radius of one foot per inch of trunk diameter (DBH).

Crown cleaning: Removal of watersprouts, dead, dying, crossing and diseased, and hazardous branches and/or removing or subordinating weakly attached branches.

Crown reduction: Method of reducing the height or spread of a tree by performing appropriate pruning cuts. (drop crotch pruning)

Crown restoration: Method of reducing the natural growth habit of a tree that has been topped or damaged in any other way.
Crown rot: disease or decay at the base of a tree or root flare.

Dieback: Condition in which the ends of the branches are dying.

Dead wooding: The removal of dead and dying branches.

Decay: Process of degradation of woody tissues by fungi and bacteria by decomposition of cellulose and lignin.

Development: The act, process or state of erecting buildings or structures, or making improvements to a parcel or tract of land.
Diameter, breast height (DBH): The diameter or width of the main stem of a tree as measured 4.5 feet above the natural grade at its base. Whenever a branch, limb, defect or abnormal swelling of the trunk occurs at this height, the DBH shall be measured at the nearest point above or below 4.5 feet at which a normal diameter occurs.

Dieback: Condition in which the ends of branches are dying.

Dripline: The width of the crown, as measured by the lateral extent of the foliage.

Emergency response: Predetermined set of processes by which emergencies are assessed and handled.

Evaluation/interval period: Time period between hazard evaluations.

Fall protection: Equipment and techniques designed to ensure a climber will not fall from a tree.

Fruiting bodies: The reproductive structures of fungi, the presence of which may indicate decay in a tree.

Girdling root: root that grows around a portion of the trunk causing the restriction of the flow of water and nutrients by choking the vascular system.

Green space: Any area retained as permeable unpaved ground and dedicated to supporting vegetation.

Green space plan: A map and/or supporting documentation that describes for particular site where vegetation is to be retained or planted in compliance with these regulations. The green space plan shall include a tree establishment plan, or a tree protection plan, and a landscape plan.

Hazard tree: The combination of a failure of a tree, or part, with the presence of a target.

Included bark: Bark that becomes embedded in a crotch between branch and trunk or between codominant stems and causes a weak structure.

Increment borer: Device used to determine tree age or detecting problems

Landscape plan: A map and supporting documentation that describes where vegetation is to be retained or provided in compliance with the requirements of this policy. It shall include any required buffer elements.

Native tree: Any tree species that occurs naturally and is indigenous within the region.

Lion tailing: A prohibited method in which limbs are thinned from the inside of the crown to a clump of terminal foliage.

Lowest permanent branch: The distance between the lowest branch and the ground, that will depend upon the site location, i.e., street tree versus sidewalk.

Mature height: The maximum height a plant can reach under favorable conditions.

Permanent branches: Branches that form the scaffold framework of a tree.

Personal protection equipment (PPE): Safety gear such as hard-hat, safety glasses and hearing protection.

Physiological disorder: A disorder not caused by insect, pathogen or injury.

Planting specifications: Detailed plans and statements of particular procedures and standards for planting.

Scaffold branches: The permanent or structural branches of a tree.

Shall: The word that designates a mandatory requirement of the ANSI standards.

Should: The word that designates an advisory recommendation in the ANSI standards.

Soil-interface effect: A phenomenon that can occur when two dissimilar soils/medias come in contact that may influence the rate and direction of water movement.

Tree establishment plan: A map and supporting documentation that describes, for a particular site where existing trees are planted in compliance with the requirements of these regulations; the types of trees and their corresponding trees for reforestations.

Tree protection plan: A map and supporting documentation that describes for a particular site where existing trees are to be retained in compliance with the requirements of the regulations, the types of trees and their corresponding tree for reforestations.

Tree protection zone - The area surrounding a preserved or planted tree that is essential to the tree's health and survival, and is protected within the guidelines of these regulations.

Utility pruning: Pruning around or near utility facilities with the objective of maintaining safe and reliable utility service.

Undercut: a cut on the underside of a limb to be removed to prevent tearing of the bark as the limb falls.

10. Communication strategy — how the campus tree care plan will be communicated to the college community and contractors to heighten awareness about policies and procedures as well as the goals of the institution. After the adoption of the Campus Tree Care Plan and Policies by the Advisory Committee and Kansas State University Administration approval, an article on Kansas State University's participation in the Tree Campus USA shall be placed in the student's newspaper "The Collegian" and K-State Today on the date when Campus Tree Care Plan is established. The plan will also be placed on the web with links from the tree inventory, construction specifications, and campus tree walk, at the Campus Planning and Facilities Management Department website.

Standard 3: Dedicated Annual Expenditures for the Campus Tree Care Program

Total Campus Tree Care Program expenditures: 2018, no changes from 2016 due to budget cuts.

Staff and Equipment:

- Kansas State University has dedicated two full time employees and 1/3 of foreperson's time totaling $138,518.39 for the tree program.
- On average, Kansas State University Facilities Grounds and Campus Planning and Facilities Management spends $20,000.00 to purchase new trees annually.

The following equipment is used in the maintenance and care of our campus trees.

Expense	Amount
Bucket truck	Total cost=$130.000. Payments are on a 5-year plan with annual payments of $26,200
Backhoe and loader attachment for tractor	$12,025.00
Stihl Chainsaws (3)	$2000.00
New Holland Skid Loader	$12,395.00
Equipment maintenance:	$2000.00
Mileage on the dump truck utilized by the tree care crew is approximately 2400 miles	(IRS Standard=$0.57/miles=$1368.00
Grand total, includes salary and new tree cost	***$223,506.00***

Standard 4: Arbor Day Observance and Standard 5: Service Learning Project

Various members of the K-State community embarked upon an exciting mission in 2013 to help ensure our campus landscape continues to beautify and benefit future generations, this resulted in our campus becoming a recognized Tree Campus USA. Each spring since, we strive to promote the care and the benefit of our campus trees. Standards 4 & 5 are student driven and are important learning components in the arboriculture course taught by Dr. Cathie Lavis.

This year's outreach endeavor was titled, *Educating the Campus Community about the Eminent Invasion of the Emerald Ash Borer (EAB).* This year's project was supported by a Green Action Fund Grant for Sustainability of $1800.00, this is sponsored by K-State Student Government.

Tree Campus events were held Thursday and Friday, April 26 and 27, 2018. In Kansas, Arbor Day is celebrated on the last Friday in April. The week's event got started with an in-class presentation on Monday, April 23. The Tree Campus USA student leaders presented a short PowerPoint on EAB in preparation for the education portion of this week. After the presentation, student leaders finalize the week's activities. Times and dates are posted on Facebook and various other venues so that the campus and Manhattan community may attend the various tree plantings and learn about Emerald Ash Borer at either of the educational tables.

Each activity had designated students who led the education and tree planting events, these were as follows:

Green Week and Arbor Day drew extra attention to campus trees in late April, 2018. Cathie Lavis, professor of landscape management, and students in the Horticulture and Natural Resources department posted signs, planted trees, and raised awareness of how important trees are to the campus and the pests that can damage them. Because of their efforts, Kansas State University earned Tree Campus USA status for the fifth year in a row.

In a letter to President Myers, the Arbor Day Foundation acknowledged the hard work involved with this project.

"To obtain this distinction, Kansas State University met the five core standards for an effective campus forest management, including establishment of a tree advisory committee, evidence of a campus tree-care plan, dedicated annual expenditures for its campus tree program, an Arbor Day observance and the sponsorship of student service-learning projects. Your entire campus community should be proud of your sustained commitment to environmental stewardship," wrote Dan Lambe, Arbor Day Foundation president.

Lavis, a core group of students and faculty as well as members of the K-State Facilities crew received support from the Student Governing Association (SGA) Green Action Fund to educate the campus community about tree care and inventory campus trees. During the summer 2017 various members of the campus and Manhattan community inventoried about 250 ash trees by doing so, a five-year strategic plan of care was developed with the guidance of the Kansas Forest Service, specifically, Kim Bomberger.

Students set up EAB displays and educational information to inform the campus community about Emerald Ash Borer.

To help detect emerald ash borers (EAB), an invasive species that destroys ash trees, 2018 arboriculture students helped remove a ring of bark from two ash trees near Dole Hall on campus. The process is called girdling. Girdled trees stand for a growing season then are removed for processing, which involves removing all of the bark on specific trunk sections to search out larval feeding galleries and EAB life stages. Although girdling and bark peeling are labor intensive and sacrifice a live tree, girdled trap trees help determine if EAB has arrived on campus ash trees.

“The reason for focusing on ash trees is the eventual and inevitable introduction of emerald ash borer,” Lavis said. “We need information regarding all of the ash trees to make critical management decisions.”

Following up in October, students in Landscape Maintenance lab helped Jeff Vogel, Program Manager with the Kansas Department of Agriculture peel the two girdled ash trees to search for potential evidence of EAB. Thankfully, nothing looked suspicious at this time. Next spring, 2019, arboriculture students will help girdle two poor ash trees. The idea is to target stressed trees that have been rated in poor to fair condition as these trees will eventually be removed during the five-year strategic EAB plan.

Other Arbor Day events included emerald ash borer informational booths that gave away free Chinkapin Oak (*Quercus muehlenbergii*) tree whips—unbranched, young tree seedlings approximately one to three feet in height and two to three years old—and selling K-State Tree Campus T-shirts to fund campus trees.

Students demonstrated how to correctly planted five trees in various locations: A paper birch tree (*Betula papyrifera*) in memory of Chris Rea ’14, donated by Tory Swope of KAT Nurseries, and a seven-son flower tree (*Heptacodium miconioides*) donated by Cameron Rees ’90, Skinner Garden Store. Both trees were planted west of Gen. Richard B. Myers Hall.

The SGA Green Action Grant funded a flowering dogwood (*Cornus florida*) near the southeast corner of Seaton Hall in honor of Provost April Mason, who is retired in June; a Lacebark Elm (*Ulmus parvifolia*); and an autumn gold (*Ginkgo biloba*).

Students watering the tree ball of a large Seven-son flower tree (*Heptacodium miconioides*). Students were demonstrating proper planting techniques. April 2018.

Kansas State University Emerald Ash Borer Readiness and Response Plan

Executive Summary

The goal of this Emerald Ash Borer Readiness and Response Plan is to acknowledge, manage, and minimize the ecological, economic, and aesthetic effects that the emerald ash borer (EAB) will have on the Kansas State campus in Manhattan, K-State Polytechnic, and other K-State properties with ash trees. A July 2017 inventory found 251 trees on the Manhattan campus and at the Kansas Forest Service, of which half were rated in fair condition, 32% in good condition, 18% in poor condition, and two trees (1%) were dead. No ash trees are present at K-State Olathe. There are 8 ash trees at K-State Polytechnic in Salina. Five trees there are in poor condition, 2 fair, and 1 in good condition.

The emerald ash borer is an exotic invasive insect in the United States that prefers native and cultivated ash trees of the *Fraxinus* genus as its host. The larval stage of the insect causes significant damage to the vascular system of the tree by disrupting the trees ability to transport water and nutrients. The damage usually starts in the canopy of the tree and as the population of the insect builds within the tree, the damage becomes more severe and more noticeable when canopy dieback, bark cracking, and epicormic sprouts occur. Chemical treatment is the only option to protect ash trees from being infested but it must be utilized as a preventative measure before 30% of the canopy is lost due to the insect's damage.

The objectives of this plan are to minimize the impact and potential for loss of ash trees on K-State properties utilizing the best-known science of the time at the lowest cost to the University; limit the exposure to liability imposed by an infestation of the EAB; protect students, faculty and staff, and visitors from hazardous trees and conditions; and maintain the beauty and efficacy of University properties.

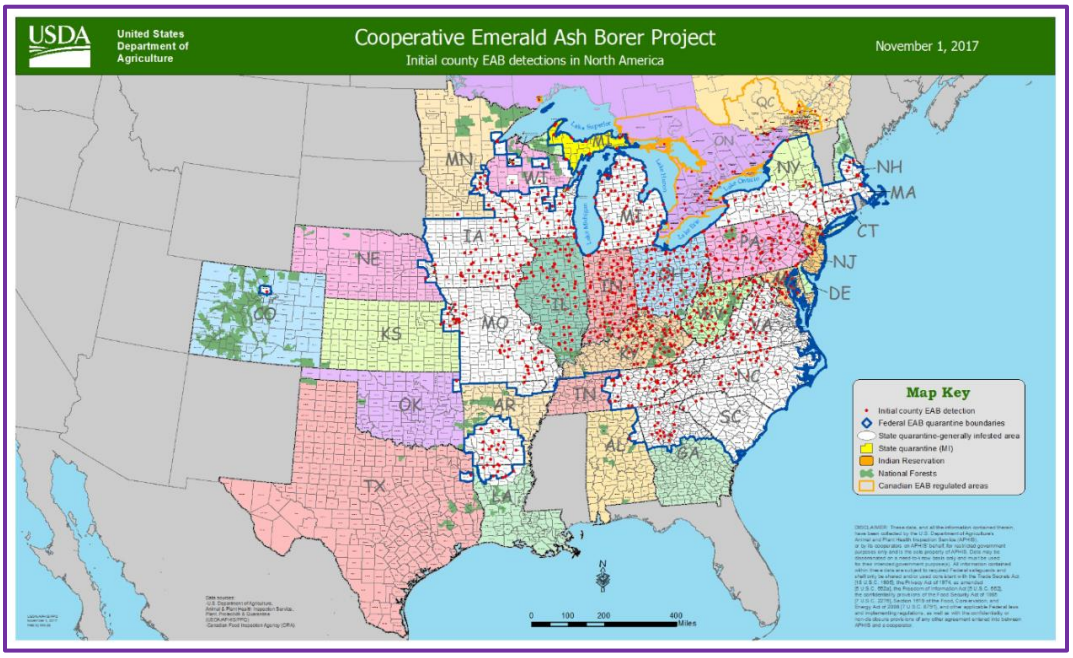
A five-year ash management strategy is proposed, with an annual review. Management strategies recommended are the removal of dead, poor, and fair condition trees and trees in poor locations. Chemical treatment will be reserved for notable and historic trees and other good condition trees that contribute to a healthy campus landscape. Tree planting will occur in advance of or in tandem with the removal of trees. Solid ash logs and those of other species will be kept for campus construction or renovation and instructional opportunities. A communication strategy to inform students, faculty and staff, alumni, and visitors to Kansas State will be developed, implemented, and reviewed annually.

Ash trees on the Manhattan campus are relatively young, with 69% less than 18" in diameter. At the Polytechnic campus in Salina, all trees are less than 20" in diameter. The Manhattan Campus Facilities Grounds Maintenance Department includes arborists, equipment, and staff that are capable of removing, treating, and planting trees. At K-State Polytechnic, these services will need to be contracted.

This readiness and response plan is intended to proactively guide the University in advance of and during an infestation of the EAB. The insect could be present now on K-State properties but undetected because the population of the insect is low. The EAB will only continue to spread in Kansas so now is the time to plan and implement management practices that will minimize its devastating effect to the University.

Introduction and Background

The EAB 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 31 states and two providences in Canada. Ash is the primary species killed by the insect but with the EAB found in a white fringetree in Ohio, it is not possible to rule out the insect moving to other tree species to survive if its preferred host is not available.



Initial county detections in North America and Canada, as of November 1, 2017.

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 (KDAPP) and USDA's Animal and Plant Health Inspection Service's Plant Protection & Quarantine (USDA-APHIS-PPQ) staff conducting a survey due to the July 2012 confirmation in Platte County, Missouri. Since that first detection in Wyandotte County, seven other counties in Kansas have confirmed the presence of the EAB: Johnson, Leavenworth, Douglas, Jefferson, Atchison, Doniphan, and Shawnee counties. Upon a detection of the EAB, a temporary quarantine is enacted and after a public hearing and signature by the Kansas Secretary of Agriculture, the quarantine order becomes permanent 90 days later. A quarantine order applies to any corporation, company, society, association, partnership, governmental agency, and any individual or combination of individuals, as stated at the Kansas Department of Agriculture emerald ash borer website - http://agriculture.ks.gov/divisions-programs/plant-protect-weed-control/emerald-ash-borer. It prohibits movement of regulated items from the quarantined area, except under specific conditions established in the permanent quarantine for the affected counties.

Regulated items under a quarantine include the following items:

- The emerald ash borer, (*Agrilus planipennis* [Coleoptera: Buprestidae]), in any living stage of development;
- Firewood of all hardwood (non-coniferous) species;
- Nursery stock of the genus *Fraxinus* (ash);
- Green lumber of the genus *Fraxinus* (ash);
- Other material living, dead, cut, or fallen, including logs, stumps, roots, branches, and composted and uncomposted chips of the genus *Fraxinus* (ash);
- Any other article, product, or means of conveyance that an inspector determines presents a risk of spreading emerald ash borer and notifies the person in possession of the article, product, or means of conveyance that it is subject to the restrictions of the regulations.

Understanding the life cycle of the emerald ash borer is 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 emergency mid to late June. Some sources indicate an emergence corresponding with the bloom of the black locust tree.
- Adults live 3 to 6 weeks.
- Yellowish eggs are laid in bark crevices 2 weeks after emergence. Eggs hatch in about 10 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 1 to 2 weeks before emerging head-first through a 1/8th inch D-shaped exit hole (at right).

Other Images of Emerald Ash Borer Damage

Faculty and staff of Campus Planning and Facilities Management, members of the Landscape Advisory Committee, and the Kansas Forest Service are equipped to serve as an interdepartmental EAB Readiness Team. This team led the effort to collect the ash data that influences the following recommendations. Outlined are measures intended to reduce the risk and negative impacts associated with the EAB on Kansas State University properties. The implementation and annual review of this plan rests with this group.

While the EAB has not been detected in Riley or Saline counties, it has been found in Johnson County. Currently, there are eight counties in Kansas under an EAB quarantine; Wyandotte, Johnson, Leavenworth, Douglas, Jefferson, Atchison, Doniphan, and Shawnee. A quarantine order requires that regulated items not be moved out of the quarantine area to prevent the spread of the insect. Additional information about the EAB in Kansas may be found at http://agriculture.ks.gov/divisions-programs/plant-protect-weed-control/emerald-ash-borer and http://www.kansasforests.org/forest_health/current_pests/emeraldashborer.html

University staff are encouraged to inspect all ash trees that are pruned and removed for the presence of the insect. These measures can include visual survey, following a branch sampling method, and the peeling of branches and trunks during removal. The Kansas Department of Agriculture's Plant Protection Program conducts annual surveys throughout the state that the Manhattan campus intends to participate in.

Inventory Results and Recommended Strategies

Trees on college campuses provide many tangible benefits. They shade buildings, sidewalks, and parking lots, mitigate heat islands, absorb carbon and other air pollutants, and provide spaces where faculty, students, and visitors can relax or study. These contributions help the University reduce energy costs, reduce negative health incidents due to improved air quality, reduce stormwater runoff from the campus, and bolster visual appeal to prospective and current students and faculty. Trees are the only infrastructure that appreciates in value and contributions as they mature but proper care and maintenance must occur for trees to mature in good health and yield the greatest benefits. The following results and recommendations are based on the data collected during the July 2017 inventory on the Manhattan campus and January 2018 inventory on the Polytechnic campus.

Summarized Ash Tree Data Manhattan Campus Inventoried July 17, 2017

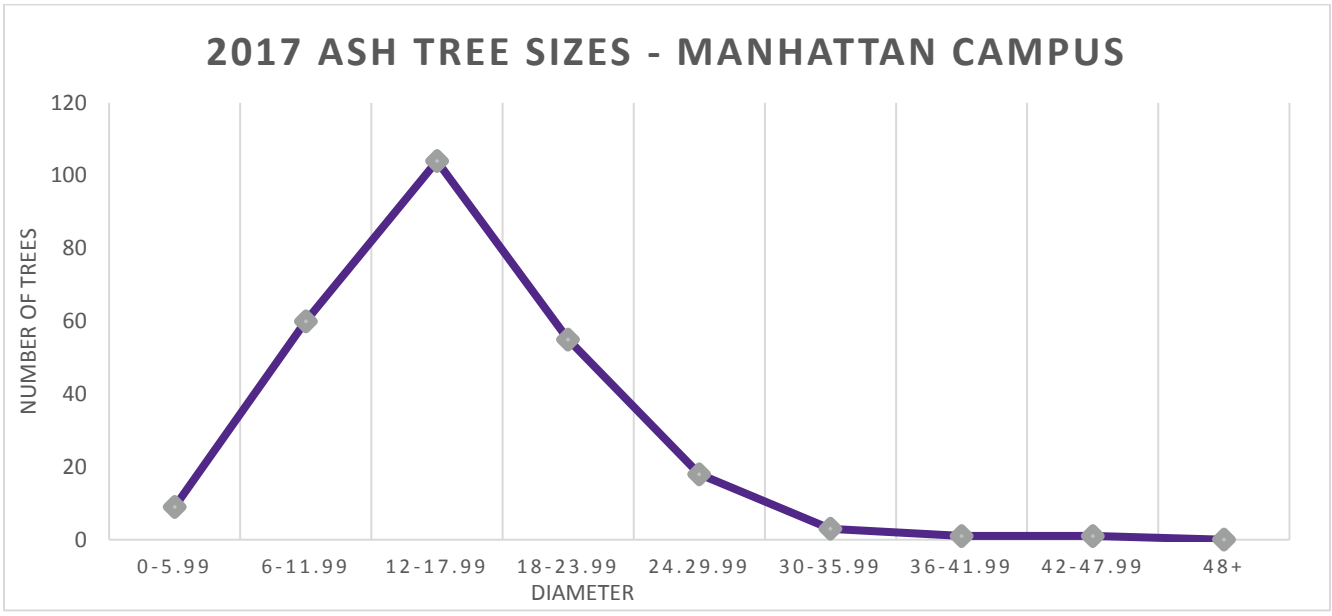
Diameter by Range

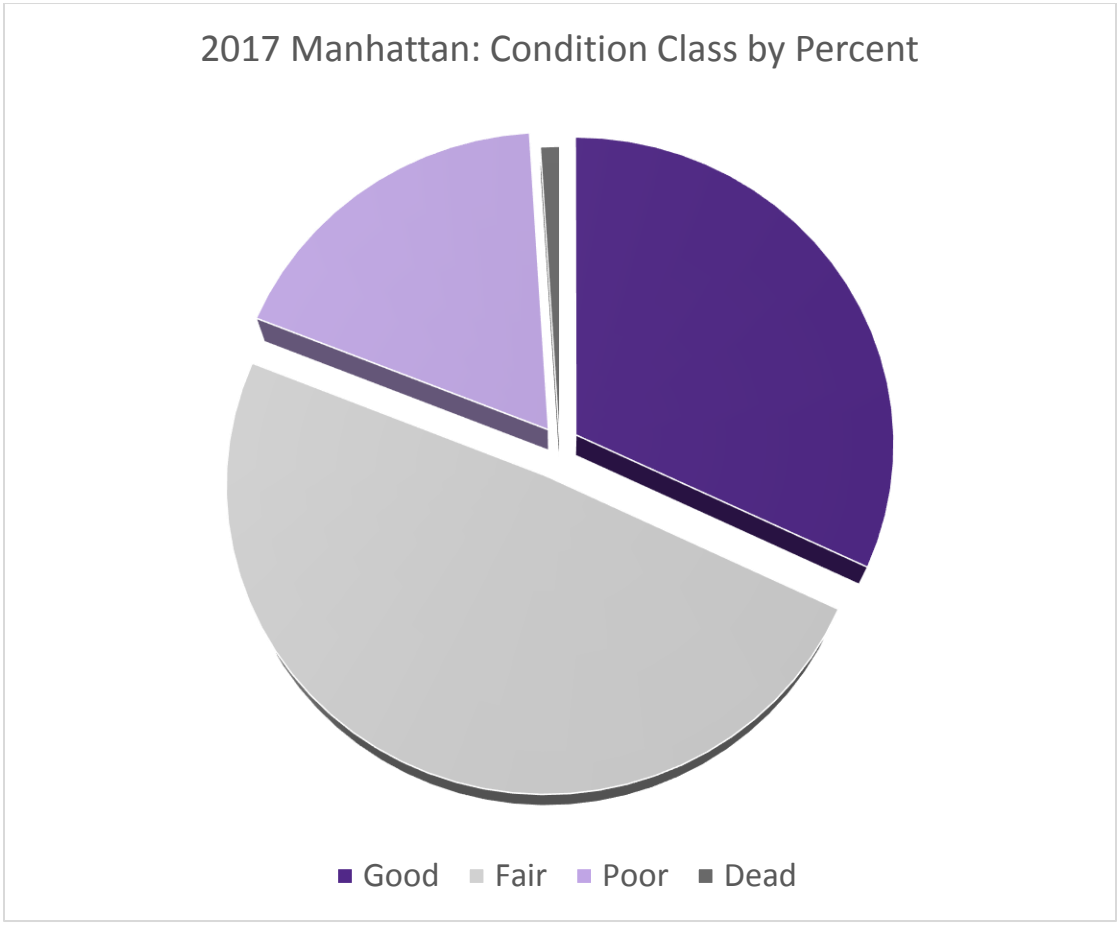
	0 to 5.99”	6” to 11.99”	12” to 17.99”	18” to 23.99”	24” to 29.99”	30” to 35.99”	36” to 41.99”	42” to 47.99”	48+”	Total Trees	Value
Good Condition											
All Ash	3	28	28	13	7		1	1		81	
Est. Value	$162	$13,692	$37,996	$34,580	$30,779		$9,174	$12,215			$138,598
Fair Condition											
All Ash	1	24	55	30	9	3				122	
Est. Value	$36	$7,824	$49,775	$53,190	$26,379	$13,137					$150,341
Poor Condition											
All Ash	5	7	20	12	2					46	
Est. Value	$90	$1,141	$9,040	$10,644	$2,932						$23,847
Dead Ash		1	1							2	$0
TOTAL	9	60	104	55	18	3	1	1	0	251	$312,786

Summarized Ash Tree Data Polytechnic Campus Inventoried January 19, 2018

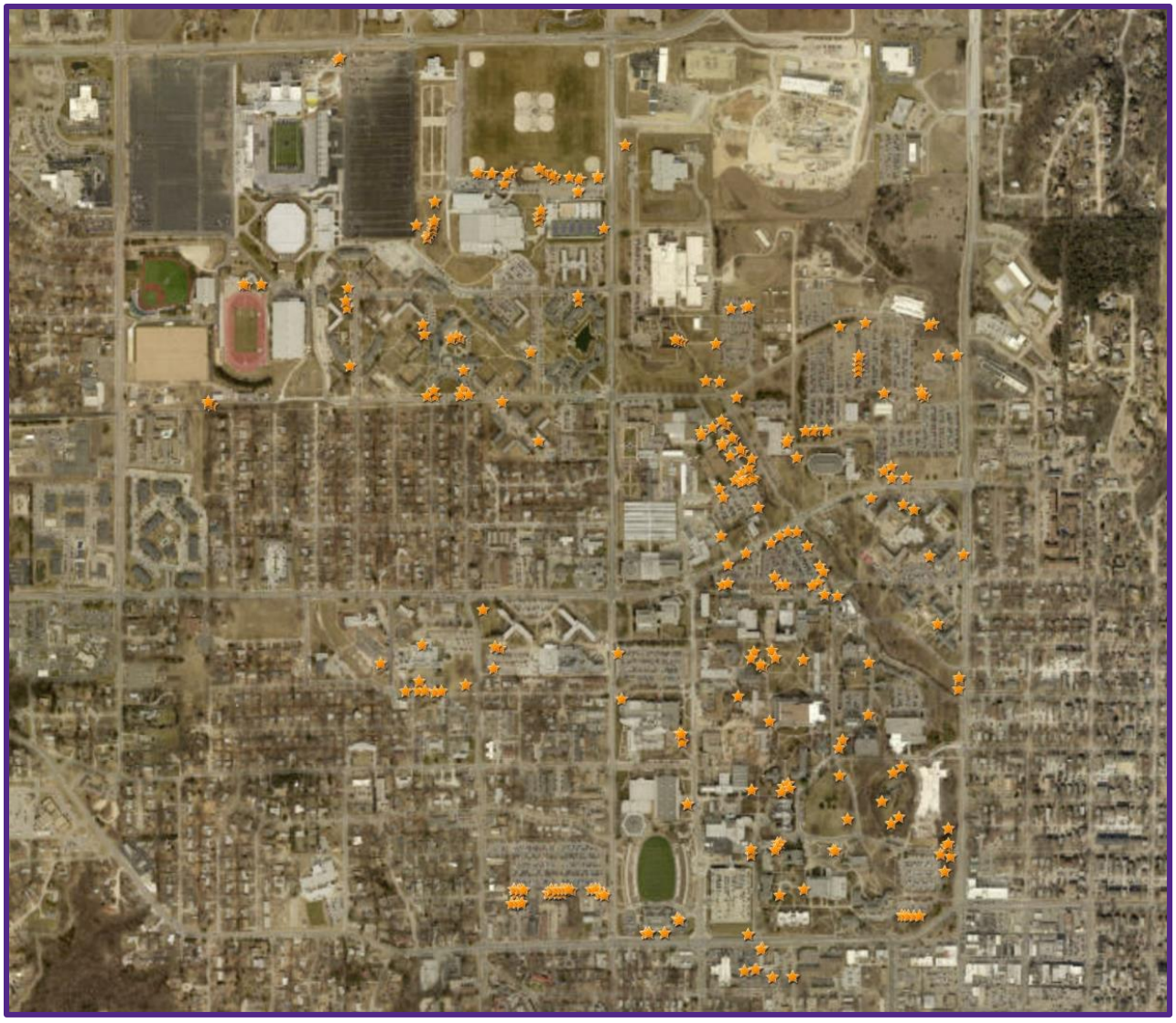
Diameter by Range

	0 to 5.99”	6” to 11.99”	12” to 17.99”	18” to 23.99”	24” to 29.99”	30” to 35.99”	36” to 41.99”	42” to 47.99”	48+”	Total Trees	Value
Good Condition											
All Ash		1								1	
Est. Value		$489									$489
Fair Condition											
All Ash		1	1							2	
Est. Value		$326	$905								$1,231
Poor Condition											
All Ash		2	1	2						5	
Est. Value		$326	$452	$1,774							$2,552
TOTAL		4	2	2						8	$4,272


2017 ASH TREE SIZES - MANHATTAN CAMPUS
NUMBER OF TREES
120
100
80
60
40
20
0
0-5.99
6-11.99
12-17.99
18-23.99
24.29.99
30-35.99
36-41.99
42-47.99
48+
DIAMETER


2017 Manhattan: Condition Class by Percent
Good
Fair
Poor
Dead

Ash Tree Locations – Manhattan



Management Strategies

In the July 2017 and January 2018 inventories, all ash trees on the Manhattan and Polytechnic campuses were classified into four condition categories, Good, Fair, Poor, and Dead. These categories are defined as:

Good	Fair	Poor	Dead
▪ Full canopy ▪ Minimal to no mechanical injury to trunk ▪ No dieback of branches over 2” diameter in the upper crown ▪ No epicormic sprouts	▪ Thinning canopy ▪ Significant damage to trunk caused by insects, disease, or mechanical injury ▪ Premature fall coloring on foliage	▪ Visible dead branches over 2” diameter in the canopy ▪ Significant dieback of living branches ▪ Severe mechanical damage to the trunk, including decay ▪ Bark is cracked or peeling	No live foliage is visible during the growing season

Approach

A proactive strategy that balances the removal and planting of trees is recommended. The strategy will be implemented in a 5-year time frame, with review after 5 years to evaluate management needed in the next 5-year cycle. Currently, there are 46 poor condition (18%), 122 fair condition (29%), and 81 good condition (32%) ash trees. The 2 dead ash trees have been removed. One hundred-four ash trees are in the diameter range 12" to 17.99" (41%), 60 trees between 6" and 11.99" (24%), 55 trees between 18" to 23.99" (22%), 18 between 24" and 29.99" (7%), and the other diameters less than 4% of the total. Ash trees on the Manhattan campus are relatively young, with 69% less than 18" in diameter. At the Polytechnic campus, the 8 trees are less than 20" in diameter, with 12% in good condition, 25% in fair, and 63% in poor condition.

Treatment

The recommended treatment for larger diameter trees is a systemic insecticide injected into the tree that is effective for two years. Other treatment products may be utilized, depending on the size of the tree and where the tree is growing. Chemical treatment will be used to prevent the EAB from killing ash trees for the long term or to prevent the infestation of trees waiting to be removed. Considerations for treatment are:

- Ash trees determined to be in good condition and in prime locations, where the loss of the trees will have an impact on the campus environment. Historic, iconic, or large healthy specimens are priorities for treatment when the EAB is detected within 15 miles of a campus.
- Good condition trees not in prime locations will not be treated initially, but will be monitored closely for any signs of decline or infestation. When the EAB is detected on campus, the condition of these trees will be evaluated to determine whether treatment is still a warranted course of action.
- The 122 fair condition trees will be monitored for infestation and decline in condition but will not be treated.
- Trees with 30% or more canopy loss will not be considered for treatment.

Removal

When a tree does not warrant treatment due to its condition or location, the best course of action is to remove the tree before the EAB establishes itself on University property. With drought and storm events also a factor to Kansas trees, ash trees rated in good and fair condition could decline to a poor or dead condition.

The Facilities Grounds Maintenance Department (FGM) will be responsible for removing any ash tree at the Manhattan campus. One hundred-seventy trees (170) were rated dead, poor, and fair. A five-year cycle for removals is recommended to allow FGM to comfortably incorporate the additional removals into its annual plan of work. Trees considered a priority for early removal include dead, dying, and poor condition trees. The next priority for removal will be fair condition ash trees. Felling 35 trees a year will remove the poor and 18% of fair condition trees in the first 2 years. The remaining fair condition trees would be removed in the last 3 years of the cycle. Services for tree management at the Polytechnic campus will be contracted.

Replacement

The Manhattan ash tree resource conservatively represents 3,951 inches of trunk diameter. It is not possible to replace the shade and ecosystem services provided by mature and maturing trees with small caliper trees, so two trees will be planted for each tree removed to more quickly fill the void of the larger trees lost and establish shade in hot locations. New trees will be selected that increase the diversity of the campus landscape and for suitability to the site where trees are removed. In this 5-year strategy, 70 trees will be planted each year for a total of 350 trees in five years. Ideally, new trees are planted in tandem with removals. When this is not possible, replacement trees will be planted in the next planting season.

Species selection will be determined by the EAB Readiness Team members. Replacement trees will be a minimum of 1.5 caliper and will be planted and maintained by FGM staff. More about planting efforts, species selection, accepting donations for new trees, etc.

Utilization

The utilization of campus trees is an important environmental and economic strategy and a valuable learning opportunity for multiple academic programs. While some ash logs may not be of a quality to be utilized for campus construction and student learning projects, that wood can be used as landscape mulch throughout the campus property. Logs that are of a quality to be milled or otherwise utilized will be stored in a marshalling yard on University property for future use. Cooperative agreements will be sought from area sawyers. Potential uses of campus trees are as flooring, wall covering, ceilings, furniture, and other interior use in new construction projects, renovations of University buildings, lab instruction, landscape structures, art, and mulch for campus landscapes.

Public Education and Communication

The Department of Communications and Marketing will assist with public education and the communication component of this plan. An outreach strategy will be developed and implemented to inform students, faculty and staff, alumni, and visitors about the EAB and the related management of the pest. Multiple media strategies will include print, electronic, and web platforms, and Arbor Day projects and outreach.

Operational and Cost Implications

An annual budget for the care, treatment, removal, and replacement of ash trees should be established and based on the following factors. Cost estimates in the table below are based on Manhattan FGM arborists and staff performing the tasks on that campus. These services at Polytechnic will be contracted and are not reflected below.

- The cost to treat a 16” ash (average size of the inventoried Manhattan population) with a systemic trunk-injected chemical ranges from approximately $30 to $100, depending on the strength of dosage. Additional costs to treat include the purchase of the injection equipment. The level of infestation will determine the strength of chemical dose needed.
- Treatment will be needed every year or two for the life of the tree or until the tree is removed. It should be expected that the cost to treat will increase as the tree grows and if product costs increase.
- The average cost to plant a 1.5 to 2” caliper tree is $500.
- The expected cost to remove a tree is $600.

Proposed Budget: Manhattan Campus

Activity	Details	Cost per Tree	Total Cost
Treatment	Chemical for 40 trees	$30 - $100	$1,200 - $4,000
Removal	Remove 35 trees per year	$600	$21,000
Replacement	Plant 70 trees per year	$500	$35,000
Annual Budget			$57,200 - $60,000

Summary

With the emerald ash borer now found in eight Kansas counties, now is the time to act. This readiness and response plan is intended to proactively guide the University in advance of and during an infestation. By doing so, the impact and potential loss from an infestation will be minimized by utilizing the best-known science of the time at the lowest cost to the University. Exposure to liability from dying and dead trees will be limited, and the beauty and natural features of University properties will be maintained and enhanced.

This Emerald Ash Borer Readiness and Response Plan was written by Kim Bomberger, Kansas Forest Service, with input from K-State Campus Planning and Facilities Management and the Landscape Advisory Committee. The plan is subject to periodic review and revision as necessary. EAB Readiness Team Members include:

Ryan Swanson	Associate Vice-President of Facilities and University Architect
Kevin Schindlbeck	Director of Facilities Services
Joe Myers	Facilities Grounds Maintenance Supervisor
Mark Taussig	Landscape Architect, Campus Planning and Project Management
Skyler Harper	Associate Director, Department of Housing and Dining
Scott McElwain	Director, Kansas State University Gardens
Charles Barden	Professor, Horticulture and Natural Resources
Cheryl Boyer	Associate Professor, Horticulture and Natural Resources
Greg Davis	Associate Professor, Horticulture and Natural Resources
Cathie Lavis	Professor, Horticulture and Natural Resources: Tree Campus USA Chair
Chad Miller	Associate Professor, Horticulture and Natural Resources
Ray Cloyd	Professor, Entomology
Chip Winslow	Professor, Landscape Architecture/Regional and Community Planning
Lee Skabelund	Professor, Landscape Architecture/Regional and Community Planning
Judy O'Mara	Instructor and Diagnostician, Plant Pathology
Chandler Day	Graduate Student, Plant Pathology
Kim Bomberger	Community District Forester, Kansas Forest Service
Randy James	President and Arborist, Growing Concerns Landscape Management
J David Mattox	City Forester, City of Manhattan

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