

**Fort Collins Emerald Ash Borer (EAB) Management and Response Plan Draft**  
**(updated April 30, 2015)**

## **Introduction and Background**

Emerald Ash Borer (EAB) is an extremely destructive insect of ash trees (*Fraxinus* species). The emerald ash borer (*Agrilus plannipennis*) is a wood boring beetle of Asian origin that has become established in many parts of the United States and Canada where native and urban ash are found. It is extremely damaging to all North American species of ash (*Fraxinus*), including green and white ash which are very common in Colorado landscape settings. It is far more damaging to our urban trees than any other insect that has previously been found in the state. As populations of this insect increase in the infested areas, all untreated ash trees will die as a direct result of EAB attacks. Entomologists consider this pest to have the potential to make North American ash extinct.

The Emerald Ash Borer is a species of metallic wood-boring beetle, also known as a flat-headed borer, which is native to parts of eastern Asia. It is not a very damaging insect in its native land due to naturally occurring biological control organisms and the natural development of EAB resistance within the native ash populations. Unfortunately the species of ash that are native to North America have very little resistance to this pest. In the Midwest and eastern areas of North America, where this insect has been present for several years, EAB has already killed many millions of ash trees resulting in losses of over \$4 billion worth of resources. Experts agree that EAB has a strong potential to ultimately kill every unprotected susceptible ash tree presently growing in North America.

Evidence suggests that this insect was introduced into North America in the late 1980's or early 1990s, probably through wooden shipping or packaging materials originating in China. However, it went undetected until it was discovered in southern Michigan in 2002. It has since spread rapidly and by the end of 2014 had been detected in 22 states and two Canadian provinces. This insect was found in Boulder in late September of 2013, making Colorado the 22<sup>nd</sup> state to detect EAB. To date, no populations of EAB have been found in other areas of Colorado.

## **Damage**

Emerald ash borer damages trees by tunneling under the bark, producing girdling wounds that interfere with movement of water and nutrients. The damage is progressive, with more effects of infestation becoming visible as increasing numbers of insects develop and feed within the tree.

When emerald ash borer first arrives and becomes established in a neighborhood it is usually present in low numbers and is very difficult to detect. However, populations tend to build steadily and within a few years it may be possible to readily observe some external visual evidence of infestation. A thinning of the leaf canopy is the most consistent symptom associated with early EAB injury.

Often, about the time symptoms first become truly noticeable, the populations of EAB explode in numbers and tree damage accelerates at a very rapid pace. During this period of peak outbreak even trees that previously appeared healthy may die within just a year or two if left untreated.

Natural spread occurs through flights of adult beetles. Normally they will fly only short distances, staying in the near vicinity of the tree from which they developed. However, some will fly longer distances and, with the aid of favorable winds, it is possible that a few may fly several miles. This natural spread will cause the Boulder EAB population to expand beyond city limits in the next few years. It will progressively encompass the areas of the state within the South Platte Drainage. This includes Longmont, Berthoud, Loveland, Fort Collins, Windsor, Greeley, the greater Denver Metro area plus all communities further down river.

Emerald Ash Borer is readily spread by humans. Ash material harboring viable eggs, larvae, pupae or adults can be moved very easily from one place to another. The EAB life stages are hardy enough to survive such transport and complete their life-cycles wherever they end up. This allows them to be moved quickly over very long distances and infest new areas. This is undoubtedly the means by which it was carried across the eastern plains and introduced into Boulder, an event which may have occurred as early as 2007. This would indicate that it went undetected for five or six years.

Geographic barriers present in Colorado, notably mountains and large expanses of ash-free terrain, can be expected to prevent natural spread of EAB to much of Colorado outside the South Platte drainage. However, the entire state will always be at risk of the insect being introduced from infested regions through the movement of infested firewood or other ash material containing live EAB life stages. National quarantines of infested counties (including Boulder County in Colorado) are in place to try and prevent this type of human-assisted spread of EAB. It should be noted that a quarantine is only effective if good enforcement efforts are funded and in place. Currently Colorado is under-funded in terms of being able to enforce the quarantine on Boulder County.

### **Generalized Life History of the Emerald Ash Borer**

Emerald ash borer has a life cycle that normally takes one year to complete. During winter the life stage present is a full grown larva that lives within a chamber cut into the outer sapwood of a host tree. In the spring it will transform to a pre-pupal phase and then continue into the pupal stage. It will transition from a pupa into the adult beetle form which will then emerge from the ash. During low population levels, this life cycle may take two years to complete.

Adults emerge from the tree by cutting through the bark, producing a D-shaped exit hole. Emerald Ash Borer will normally begin to emerge in early to mid-May, with peak emergence in June. However, some beetle emergence could extend into midsummer.

After emergence, adults move to the crown of an ash tree where they feed on leaves, making small cuts along the edges. After about a week of feeding, the now mature adults will begin to mate. A few days after mating the females will begin to lay eggs on the surface of the bark, usually deposited singly into cracks and crevices. Females typically live for about a month and during this time will lay several dozen eggs.

Eggs hatch in about a week and the tiny, newly hatched larvae burrow through the bark. They enter and begin to feed on the tissues under the bark which includes the phloem, cambium and outer sapwood.

This is where the entire larval stage occurs. During the course of feeding the larvae produce meandering galleries that progressively widen as the larvae grow. Ultimately the gallery produced by a single larva may range over an area ranging from 4 to 20 inches (10-50 cm) in length. Larvae feed until cooler fall temperatures arrive. They then prepare to overwinter by tunneling a bit deeper into the sapwood to produce an overwintering chamber.

Trees in poor health may have very little ability to tolerate and repair EAB damage. However, when large numbers of EAB are present and reproducing, even vigorously growing ash trees will be quickly overwhelmed by EAB attacks and decline rapidly.

Initial tree health is one factor to consider, but another important factor is the size of the local EAB population. When emerald ash borers originally colonize a neighborhood they are present in low numbers and trees may sustain very little damage during this initial period of establishment. However, EAB populations build rapidly and within 5 years of the initial infestation very large numbers will be present. When EAB outbreaks peak, large numbers of eggs are laid and large amounts of injury usually occurs in a very short time. Trees may be so extensively damaged that they will die within one or two years of initial infestation.

The timely use of effective pesticides can prevent much of the injury and preserve trees. Treatments may stabilize the effects of past EAB injury up to a certain point. If injuries have not been too extensive and effective treatments are used, trees may even recover. As a guideline, ash trees that are showing less than 30% crown thinning as a result of EAB injuries may recover if effective treatments are employed; trees showing greater evidence of injury likely cannot be salvaged by any treatments. These canopy thinning estimates may vary on a case by case basis.

The Emerald Ash Borer is now a permanent resident in Boulder and not really all that far away from Fort Collins. All experts agree that it is no longer a matter of “if” EAB will get to Fort Collins but rather “when”. As such, following is an Emerald Ash Borer Response Plan for Fort Collins.

## **Response Plan**

An Emerald Ash Borer response plan is composed of several components based on whether our efforts are focused on the pre-detection, early infestation, rapidly increasing mortality phase or late infestation stages of invasion by this pest. This document must remain dynamic and sensitive to current conditions and research updates as they become available.

### **Pre-Detection Stage**

**Inventory:** City Forestry recently completed a project that updated and upgraded our street and park tree inventory to a GIS/GPS based system. A current and accurate tree inventory of City owned trees is vital to any effort in preparing for an EAB invasion. The inventory provides current data on the number, size and placement of all ash trees on developed City-owned properties. This data is vital in determining the value of public ash within the City and should allow us to develop cost/benefit analysis estimates for

various treatment or control options. The inventory allows us to identify the condition of individual ash trees. From this we can determine which trees are worth treating and which are not. We now know that Forestry is responsible for 47,000 trees on City property and 18% of all those trees are ash (8,189 total ash trees on City property).

Forestry utilized tree benefit calculators to aid in establishing the values and contributions that City owned ash trees make to the community in terms of property values, storm water management, carbon storage, energy savings, water savings and other beneficial factors. Total ecological benefits are determined to be \$1.3 million per year for the 8,000 plus ash on City property.

Forestry received funding to complete an inventory of ash on private property. During the summer of 2015, Davey Resource Group will conduct an *i-Tree Eco* analysis of private trees in Fort Collins. Data will be collected from at least 200 plots distributed across our City. The data will be analyzed and allow us to estimate the number of ash trees on private property within the City's urban growth area. The analysis will also give us the total ecological benefits that the ash tree population provides each year. This will help in the estimation of the total overall impacts that EAB will have on Fort Collin's urban forest.

**Sampling & Detection Efforts:** Monitoring to increase our chances of early EAB detection is another important goal for Forestry. Even though EAB traps are available, the attractants used are not very effective at drawing adult beetles into the traps. Research is ongoing to determine more effective ways to trap and monitor for EAB. The Emerging Pests In Colorado (EPIC) committee and Colorado EAB Response Team are in continual contact with national and international experts regarding improved ways to conduct sampling. One method to consider is to girdle live ash trees and let them stand during the flight periods of EAB. This method has proven to be slightly more effective than the purple or delta traps at attracting EAB. Forestry will determine whether the creation and use of trap trees could help as we search and monitor for EAB.

Currently we are working on a sampling plan that will collect ash samples from across our urban growth area. The sampling technique is based on recommendations given to Colorado by Dr. Krista Ryall from the Canadian Forest Service. Following is an outline for sampling protocol starting with education:

- A. Educate our staff through:
  - a. EAB University Sessions (optional)
  - b. Purdue EAB program (optional)
  - c. Seminars/Workshops (required and completed)
  - d. Hands On training in Boulder (completed)
  - e. Other opportunities as they come up (assess opportunities as they come up)
- B. To the extent feasible, Forestry field crews will inspect for the presence of EAB in any ash tree they work on.
- C. Educate and encourage local, licensed arborists to be trained and inspect every ash they work on. Ask them to report any suspicious trees or samples they encounter directly to City Forestry. (This has occurred through local interaction with companies, HOA's etc... but also through two separate annual licensed arborist meetings that we hold every December).
- D. Forestry will follow sampling parameters as established by Dr. Ryall and other researchers:

- a. A 1 mile by 1 mile grid system and overlay has been created on a GIS map of the City based off a grid that APHIS and CDA provided. Forestry will sample 5 random City-owned ash trees within each grid using the protocol established in Canada:
- b. Remove 2 branches, ranging from 2 to 6 inches in diameter, from mid to upper crown on the south side of each tree.
- c. Look closely in the branch union areas and at the leaders of sampled trees.
- d. Select trees that appear to be stressed (rationale is that stressed trees are more attractive than healthy trees when EAB are at low population levels).
  - i. Parking Lots
  - ii. Distribution centers and national big box stores etc...
- e. Catalog each sample for tracking purposes following Boulder's established guidelines.
  - i. Peel the bark and into the outer rings of sapwood following established protocol.
  - ii. Two options exist:
    - 1. Bring branch samples to the Park Shop and peel them here. If it is during EAB flight risk season then the samples will need to be contained in a closed container during transport.
    - 2. Peel the samples in the field utilizing a truck mounted vice or similar device to stabilize the samples for peeling.
- E. Place and monitor traps based on APHIS recommendations.
- F. Determine if using trap trees is advisable for Fort Collins in 2015 and 2016. This is a process where existing ash trees are girdled and left standing during the flight season of EAB. Preferably trees that are in moderate to poor condition would be used.
  - a. Certain nurseries may have stock they would donate for this purpose
  - b. Identify potential trap tree candidates when doing grid survey work
- G. Conduct inspections on any suspicious trees reported by citizens or other sources

**Forest Management Considerations:**

**Big picture management decisions.** There are some major management decisions to be made when dealing with this pest. These decisions may need to be modified once EAB is actually detected in Fort Collins. The three largest decision questions are: 1) How many of our ash trees are we going to attempt to preserve and protect from EAB; 2) How are we going to address EAB issues on private property; and 3) How will management programs be adequately funded? Finding answers to these questions will direct how the City will respond once the pest is found in our community.

**Forestry will employ multiple management options when dealing with ash trees on City owned land. The following paragraphs list a variety of options available for use:**

**Increase species diversity.** Over the past several years, City Forestry has been proactive in anticipation of the arrival of Emerald Ash Borer. This has included a ban on planting ash on any new City projects and on City rights-of-way in new developments. In order to spread pertinent information, our public outreach and education efforts will need to increase. The overall message should include the need to improve species diversity within our urban forest by: 1) eliminating ash from the planting pallet; 2) encouraging property owners or managers to rate the value and condition of their existing ash trees so they can make informed management decisions regarding whether to treat for EAB or not; and 3) recommending the use of multiple tree species that will perform well in our city to plant in place of ash. Outreach

efforts should include citizens, nurseries, garden centers and other entities including the County Forester, local arborists, County Extension agents and the Colorado State Forest Service. Coordinating efforts with nearby communities may also be advisable.

Part of this strategy is to use the inventory to identify ash on City property that are rated as being in poor condition. Forestry can begin the process of phasing these trees out and getting replacement trees planted now rather than waiting for the pest to become established. Taking such action will help distribute the overall impact of EAB in our community over a longer period of time. The economic and workload implications of spreading out the impact of tree losses and replacements over a longer period of time are substantial.

**Explore The Possibility of Adding Staff and Equipment.** The work load for the Forestry Division will increase dramatically once Emerald Ash Borer becomes established in Fort Collins. Consideration should be given toward adding extra staff and equipment. EAB response and management activities will take a lot of time and resources away from normal Forestry functions such as planting, pruning, other removal work etc... Extra staff would help in mitigating the impact EAB will have on how Forestry functions.

**Establish A marshalling Yard Site.** Forestry purchased a portion of the Hoffman Mill site to be utilized as a marshalling yard for EAB. This site is also the primary area where Forestry stores and processes wood and tree debris from our normal, non-EAB tree management activities. All ash material would have to be kept separate from other woody waste.

**Establish Funding.** Forestry will explore the idea of establishing funding source just for Emerald Ash Borer management and mitigation. Some considerations should include, but not necessarily be limited to: 1) public outreach and education; 2) tree removal and replacement costs; 3) extra contractual moneys; 4) ash wood market development and utilization; 5) land purchase or lease options to act as a marshalling yard; and 6) eventual control efforts (pesticide applications or injections). Forestry will explore the possibility of obtaining grants, or other funding sources, to help fund EAB management in Fort Collins.

**Keep Up To Date On Current Recommendations Regarding Treatment Options.** Emerald Ash Borer treatment options are receiving a lot of attention throughout North America. Chemical treatments are currently the most effective way to preserve desirable ash trees within areas that are infested. Ongoing research will help modify treatment options as each year goes by.

We must stay up to date regarding the most current recommendations for several reasons. One is simply because it is important to maximize control efforts while trying to keep the costs at some manageable level. Other reasons involve environmental considerations for pesticide use. Each application of a pesticide involves some sort of trade off with the environment. As research continues we will undoubtedly learn more on how to minimize negative environmental impacts and yet still preserve a segment of our ash population.

This becomes more critical as we look at ash on private property. Up to 90% of the ash in the city may be on private property. The potential environmental impacts of pesticide use will be much greater from private property applications than from those on City property. It will be very important to educate pesticide applicators and property owners on the most current treatment recommendations available.

Currently, the Forestry Division will discourage pesticide use for the prevention of EAB within City limits. Until a clear and present threat is detected, the use of pesticides in Fort Collins is unwarranted for this pest.

**Reduce the probability, or delay, the onset of the initial infestation.** All indications are that Emerald Ash Borer will become established in Fort Collins at some point in time. In fact, EAB may be within the city now and we simply have not detected it. However, it is a good forest management practice to take whatever steps we can to delay the onset. There may not be a lot we can do, but following are some options to pursue:

1. The Colorado Department of Agriculture (CDOA) has enacted a permanent quarantine for Boulder County and parts of Weld and Jefferson Counties. Fort Collins Forestry should take steps to aid the Colorado Department of Agriculture in educating our local arborists as to the rules and regulations of the quarantine. Forestry will urge each licensed arborist to sign a compliance letter with the CDOA stating that when (if) they work in Boulder County they will not transport any ash material outside the quarantine area. This compliance would be extended to any other counties as they come under quarantine.
2. City Forestry is currently reviewing the existing municipal code to determine if changes should be made to help restrict the movement of infested or diseased tree material within or into the city. A code change could give City Forestry authority to regulate such movement, but strict enforcement would be difficult.
3. Increase public awareness and education of the risks involved with transporting ash wood and other ash debris into Fort Collins or the surrounding areas. This would include a description of the impact and damage that will undoubtedly occur once it gets established in our community.
4. City Forestry must stay informed on the spread and detection of Emerald Ash Borer in Colorado, but also in surrounding states. Current and accurate information is useful in determining the rate of spread from known areas of infestation. Public knowledge of where current infestation areas occur may help spread the message (word of mouth communications where someone here knows someone there and tells them not to bring firewood when they come and visit, etc...) not to move ash wood or debris.

**Other preparations.** There are other steps or measures Forestry may be able to explore to help us be prepared for the invasion. We will be looking at our current vegetation code to determine if we need to implement changes that will allow us to manage the impacts more effectively.

Options for consideration will include:

1. Grant City Forestry authority to allow the option of an approved chemical treatment, rather than removal, in ash trees showing less than 30% crown damage due to EAB. (Notice To Remove could be changed to Notice to Remove or Treat). This would only be used very early in the infestation cycle as an effort to slow the spread in our city.
2. Allowing EAB infested trees to stand, but the property owner would be put on notice that when the tree is removed, the wood and debris must be handled, transported and disposed of in a prescribed manner (follow BMP's).

**Pre-Detection Education and Outreach:** Following are some goals and ideas for keeping all interested parties, public and private, informed of the issues centering on Emerald Ash Borer:

- a. Increase public awareness and education about the threat of EAB (on-going)
  - i. Involve public media agencies (articles and advertisements)

1. Newspaper
  2. Radio
  3. TV
  4. Bus Benches, Billboards, etc...
- ii. Direct citizens and interested parties to the Colorado EAB website: [www.EABColorado.com](http://www.EABColorado.com)
  - iii. Develop a City of Fort Collins EAB website
  - iv. Hold educational workshops to emphasize impact and how to inspect for the pest, and also what to do if a suspicious sample is found. Include:
    1. Inter-agency
      - a. CSU
      - b. Colorado Department of Agriculture
      - c. Larimer County
      - d. PSD
      - e. CSFS
      - f. CSU Extension etc.....
    2. Intra-Agency
      - a. Managers
      - b. Boards
      - c. Council
      - d. Other Departments
    3. Arborists
    4. Landscape Companies
    5. Citizens
- b. Involve local businesses associated with the Green Industry by providing public-friendly literature they can have to give to the public
    - i. Nurseries
    - ii. GOSC
    - iii. Arborists
    - iv. Irrigation supply companies
    - v. Others (Jax, COOP, Lowes, Home Depot, etc....)

**Post-Detection Early Stages (In development)**