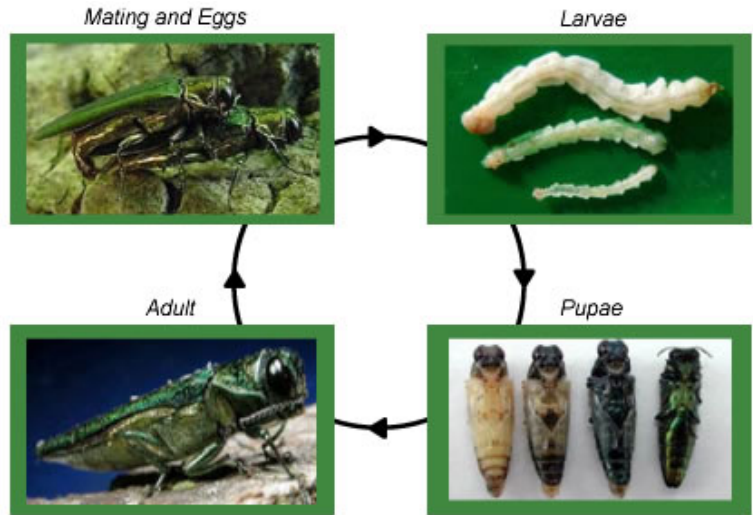


CLEVELAND METROPARKS EMERALD ASH BORER MANAGEMENT PROGRAM: BACKGROUND AND ASH (*Fraxinus*) MANAGEMENT RECOMMENDATIONS

Cleveland Metroparks Technical Report 2011/NR-04



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BACKGROUND

Emerald ash borer (EAB) (*Agrilus planipennis*) is a wood-boring beetle that completes its lifecycle on ash trees (*Fraxinus* spp.). Native to Asia, this beetle was first identified killing ash trees in the Detroit Michigan area in 2002. EAB likely arrived to the United States as a result of an accidental introduction of infested shipping pallets originating from China. Since its discovery, EAB has killed tens of millions of ash trees throughout the U.S. Michigan, Ohio, Illinois, Indiana, Kentucky, Minnesota, Missouri, New York, Pennsylvania, Tennessee, Virginia, West Virginia, and Wisconsin and in Canada in Ontario and Quebec.

There are many native wood-boring species (*Agrilus* spp.) in the eastern United States. These species have co-evolved with their native host tree species for tens of millions of years and typically do not cause significant tree mortality. Similarly, in its native range EAB is not considered a pest and only causes mortality when the host tree is already stressed or diseased. The relationship between borer and host tree is maintained by a co-evolutionary history that allows both species to persist on the landscape. Because native ash trees lack this co-evolutionary history with EAB, they are susceptible to mortality rates much higher than those experienced by Asian species of ash trees. This increased mortality rate has also been observed when U.S. native ash trees are planted in China. Based on studies to date, ash mortality is near 100% within 5-6 years after a tree is colonized by EAB. In addition, as ash trees die, they quickly become brittle and can lose branches or snap-off at various heights. Options for ash tree management include: 1) doing nothing and letting trees decay and fall in place, 2) treating trees with approved insecticides prior to or soon after initial infestation, 3) removing trees prior to or in the early stages of infestation using Forestry Division staff or contractors, and 4) removing trees after severe infestation. Because dead and dying ash trees are prone to branch and trunk failure, tree removal must be managed proactively, either prior to or just after infestation, to reduce risk to patrons and Park District staff. For this reason, option 4 is not a preferred option.

EAB management must consider the need for enhancement plantings at sites affected by EAB. This could involve decisions from single tree plantings using species other than ash that are adapted to a particular community up to large scale restorations involving sites up to 10 acres in size in Cleveland Metroparks. Over time, tree replacement with non-ash tree species is less expensive than treating individual ash trees with insecticide; however, the social and scientific value of preserving ash genotypes is incalculable. In addition, the Division of Natural Resources will also be monitoring the natural areas of Cleveland Metroparks to identify potential ash trees that appear tolerant to EAB. Known as lingering ash, these are trees that persist on the landscape with visually healthy canopies when surrounding ash trees are declining due to EAB.

STATE OF ASH TREE MONITORING AND ASSESSMENT AS OF 2010

The first EAB record for Cuyahoga County was in 2006 along I-71 near Middleburg Heights. Effective October 2006 Cleveland Metroparks modified public policy to prohibit the transportation of firewood through Cleveland Metroparks. Significant EAB infestations were documented in 2008 along Big Creek Parkway and in Brecksville Reservation. In April of 2008 emerald ash borer and forest management policies were written to provide guidelines for infested ash tree removal from public areas. As of January 2010, all 7 counties within Cleveland Metroparks land holdings were designated as “quarantined” by the Ohio Department of Agriculture’s Emerald Ash Borer Program. At that time Cleveland Metroparks Emerald Ash Borer Compliance Agreement for ash wood and related materials handling was updated. Organizational meetings were initiated in September 2010 to discuss future emerald ash borer management strategies. These bimonthly collaborative meetings have representatives from Natural Resources, Forestry, Park Operations, Marketing and Outdoor Education. Eight overarching concerns related to EAB were identified: 1) public safety, 2) ash debris management, 3) reforestation efforts, 4) work load feasibility (in-house or contract), 5) public relations, 6) chemical treatment of ash trees, 7) EAB monitoring and 8) biological control options.

Cleveland Metroparks has assessed the number of ash trees and their distribution as part of three different surveys. The first was a targeted survey of ash in high use public areas (picnic areas, golf courses, etc.) was conducted in 2007. The second and third are vegetation monitoring programs based on a randomized sampling designs in natural areas across the Park District. The combined information from these surveys illustrates the dominance of ash trees in high public-use areas (Figure 1) as well as in natural areas (Figure 2).

Four reservations (Rocky River, Mill Stream, Big Creek and Hinckley) were determined to have the highest relative abundance of ash of all reservations. Each of the 3 survey programs independently identified these same four reservations as having the greatest number of ash. Figures 1 and 2 also illustrate the locations of known and suspect EAB infestations. Positive EAB locations have been verified through the use of purple prism traps, observation of EAB exit holes, and larvae observed through bark scraping. Suspect EAB locations are indicated by trees with thinning canopy and woodpecker damage. It should be noted that the areas with the greatest number of ash are the same areas with greatest amount of EAB present. Therefore, from a time-line and financial management coordination standpoint, ash tree removals and reforestation efforts are a current Park District concern that could last another 10-15 years.

Specific information about each survey is detailed below.

Survey of Ash in High Use Areas (2007):

A rapid survey of ash trees in high public use areas of Cleveland Metroparks (picnic areas, golf courses, etc.) found nearly 4,000 ash trees, with approximately 1,200 of these located in the Park District's 7 golf courses (Jack Schultis 2007, internal document) (Map 1 & Table 1) (Note: Seneca Golf Course the Park District's eighth golf course has not been surveyed for ash trees as of January 2011). Significant populations of ash trees exist in and around golf courses, and the relative abundance of ash trees on golf courses can be greater than the ash trees in the surrounding reservation. For example, Manakiki Golf Course in North Chagrin and Sleepy Hollow Golf Course in Brecksville have a greater ash abundance compared to the rest of their respective reservations (Map 1, Table 1). Priority areas for contract removal have been identified (Appendix A).

This assessment did not account for ash trees along parkways, all purpose trail borders, property lines, or bridle and hiking trails that may pass through ash-dominated forests. Moreover, it did not include ash trees along other road rights-of-way that are managed by other agencies. However, it is estimated that an additional 4,000 ash trees will need to be removed in these areas (Mack and Englehart, personal communication).

Vegetation Monitoring/Deer Browse Assessment (2003-2010):

Since 2003, Cleveland Metroparks has sampled over 1,000 vegetation plots to monitor deer browse intensity in the seven large reservations (Bedford, Brecksville, Hinckley, Mill Stream Run, North Chagrin, Rocky River, and South Chagrin) (plus West Creek). The data collected at these plots included stem counts of trees <5 cm (< 2 in), 5-20 cm (2-8 in), and >20 cm (>8 in) dbh (diameter at breast height). Using this information, it is estimated that over 110,000 ash trees over 20 cm (8 inches) are growing in Cleveland Metroparks (Appendix B). Importantly, the distribution, number and density of ash trees vary substantially by reservation. Rocky River, Mill Stream and Hinckley reservations account for over 73% of all ash trees and 74% of trees over 20 cm. These same relative proportions were also observed as part of the rapid survey in high use areas (Table 1) and also equivalent to the proportions observed in the first year of the Plant Community Assessment Program (PCAP) (Table 2).

Table 1. 2007 Rapid survey of ash trees in high use areas of Cleveland Metroparks.

| Reservation | 4-6 in dbh | 7-12 in dbh | 13-20 in dbh | 21-28 in dbh | 29-36 in dbh | Total | % total | Total | % of total park + golf |
|----------------------|------------|-------------|--------------|--------------|--------------|-------------|--------------|-------|------------------------|
| Bedford | | 72 | 60 | 8 | 4 | 172 | 4.4% | 331 | 8.4% |
| Shawnee Hills Course | 15 | 61 | 69 | 7 | 7 | 159 | 4.0% | | |
| Big Creek | 64 | 101 | 56 | 13 | 3 | 237 | 6.0% | 237 | 6.0% |
| Bradley Woods | 5 | 10 | 4 | 1 | 0 | 20 | 0.5% | 20 | 0.5% |
| Brecksville | 33 | 53 | 25 | 2 | 2 | 115 | 2.9% | 347 | 8.8% |
| Sleepy Hollow Course | 72 | 103 | 49 | 7 | 1 | 232 | 5.9% | | |
| Brookside | 48 | 63 | 5 | 0 | 0 | 116 | 2.9% | 116 | 2.9% |
| Euclid Creek | 39 | 54 | 31 | 3 | 2 | 129 | 3.3% | 129 | 3.3% |
| Garfield Park | 19 | 41 | 48 | 10 | 4 | 122 | 3.1% | 122 | 3.1% |
| Hinckley | 122 | 273 | 163 | 19 | 5 | 582 | 14.7% | 582 | 14.7% |
| Huntington | 4 | 15 | 12 | 1 | 0 | 32 | 0.8% | 32 | 0.8% |
| Mill Stream Run | 49 | 89 | 114 | 18 | 1 | 271 | 6.9% | 271 | 6.9% |
| North Chagrin | 56 | 63 | 43 | 6 | 7 | 175 | 4.4% | 418 | 10.6% |
| Manakiki Golf Course | 44 | 94 | 93 | 11 | 1 | 243 | 6.1% | | |
| Ohio & Erie Canal | 65 | 56 | 15 | 3 | 0 | 139 | 3.5% | 139 | 3.5% |
| Rocky River | 64 | 176 | 224 | 71 | 29 | 564 | 14.3% | 1049 | 26.5% |
| Mastick Woods Course | 9 | 49 | 68 | 13 | 10 | 149 | 3.8% | | |
| Big Met Course | 13 | 75 | 86 | 21 | 13 | 208 | 5.3% | | |
| Little Met Course | 8 | 36 | 67 | 12 | 5 | 128 | 3.2% | | |
| South Chagrin | 18 | 43 | 45 | 13 | 5 | 124 | 3.1% | 124 | 3.1% |
| Washington | 7 | 18 | 11 | 0 | 0 | 36 | 0.9% | 36 | 0.9% |
| West Creek | 0 | 0 | 0 | 0 | 0 | 0 | 0.0% | 0 | 0.0% |
| TOTAL | 754 | 1545 | 1288 | 239 | 99 | 3953 | | | |

Plant Community Assessment Program (2010):

Because Cleveland Metroparks is experiencing early stages of invasion by EAB, several initiatives have been started to track decline of ash trees in the Park District. In collaboration with the U.S. Forest Service, Cleveland Metroparks collected extra data on all ash trees > 10 cm (4 inches) encountered during the 2010 Plant Community Assessment Program (2010 PCAP). This included ash condition data (size and crown condition) as well as EAB indicator data including presence of epicormic branching along the boll of the tree, woodpecker damage and the number of EAB exit holes at eye-level on all ash trees sampled.

Ash trees were found in ten of fourteen reservations sampled during 2010 (Map 2). The four reservations that did not have ash trees recorded (Euclid Creek, Brookside, Washington and Ohio & Erie Canal) had only single survey plots, and this limited sample size does not accurately reflect the presence or absence of ash in those reservations. Out of the 108 total plots surveyed, ash occurred in one-third of plots sampled (33%). Within each reservation the occurrence of plots with ash varied between 8%-66% (Table 2). Four reservations (Rocky River, Mill Stream Run, Hinckley, Big Creek) had ash trees present in half or more of their plots. The initial assessment of ash composition across Cleveland Metroparks natural areas shows that ash is a significant subdominant species in at least four reservations with localized stands containing ash of varying densities in other reservations.

Table 2. Number of plots with ash trees as a percent of total plots sampled by reservation.

| Reservation | Reservation Code | Total # of plots sampled | # plots w/ash | %plots w/ash |
|-------------------|------------------|--------------------------|---------------|--------------|
| Big Creek | BC | 3 | 2 | 66.7% |
| Hinckley | Hi | 14 | 8 | 57.1% |
| Mill Stream Run | MS | 13 | 7 | 53.8% |
| Rocky River | RR | 12 | 6 | 50.0% |
| Bedford | Be | 12 | 4 | 33.3% |
| Bradley Woods | BW | 3 | 1 | 33.3% |
| North Chagrin | NC | 15 | 4 | 26.7% |
| South Chagrin | SC | 10 | 2 | 20.0% |
| West Creek | WC | 10 | 1 | 10.0% |
| Brecksville | Br | 12 | 1 | 8.3% |
| Euclid Creek | EC | 1 | 0 | 0% |
| Brookside | Bk | 1 | 0 | 0% |
| Washington | Wa | 1 | 0 | 0% |
| Ohio & Erie Canal | OE | 1 | 0 | 0% |
| Huntington | Hu | 0 | NA | NA |
| Garfield Park | GP | 0 | NA | NA |
| TOTALS | | 108 | 36 | 33.3% |

As part of PCAP 2010, data was also collected for the urban forestry analysis tool i-Tree Eco. This USDA Forest Service software program uses field data on crown size and quality to quantify urban forest structure and environmental services that trees provide (<http://www.itreetools.org/>). Based on i-Tree Eco estimates, approximately 1.4 million trees >10cm dbh are found on Cleveland Metroparks property with ash species accounting for approximately 88,000. This is somewhat less than the estimate of 110,000 trees in the previous internal survey. The majority of ash trees are less than 30 cm dbh (Figure 1), and ash trees comprise approximately 6.3% of the total forest composition, which is comparable to statewide estimates for Ohio (Widmann 2008).

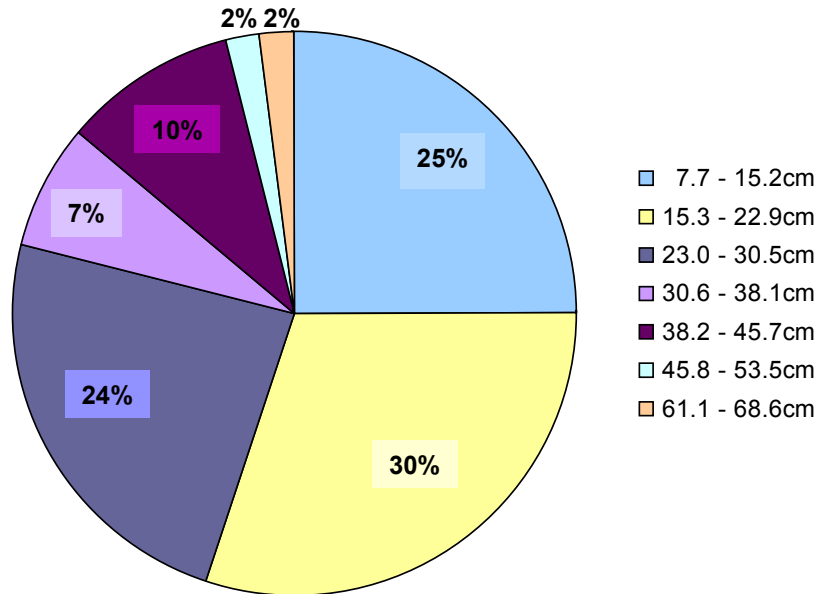


Figure 1. Percent of ash tree population in Cleveland Metroparks by DBH size class according to i-Tree Eco.

White ash made up approximately 54% of ash trees surveyed with an average dbh of 23.5 cm. Green ash comprised the remaining 46% with a slightly larger average dbh (25.5 cm). No pumpkin or black ash were surveyed although these species do occur in the Park District (Table 3).

Table 3. Average size and number ash trees encountered by species across all reservations.

| By Species | # of trees | Avg dbh (cm) |
|--|------------|--------------|
| <i>Fraxinus americana</i> (White) | 65 | 23.5 |
| <i>Fraxinus pennsylvanica</i> (Green) | 56 | 25.5 |
| Total | 121 | 24.5 |

All individual ash trees within plots were measured and assessed for tree condition (Table 4). Diameter at breast height (dbh) is a measurement of tree size and a proxy for dominance. Canopy condition is determined by assigning an average crown rating on a 1-5 scale, which was developed to quantify crown dieback (Smith 2006).

Crown Ratings:

1. Healthy, full canopy tree: Complete canopy
2. Thinning canopy: All branches have leaves but the canopy appears sparser than it should.
3. Dieback: Canopy is thinning with some dead branches at the top.
4. >50% Dieback: Canopy has less than half the leaves of a healthy tree and/or ½ of the top branches are dead
5. Dead Tree: No leaves remain. Applies even if there are epicormic sprouts along bole of tree.

External stress symptoms were also assessed for individual trees as a proxy for EAB activity. These stress symptoms include counting the number of adult EAB exit holes at eye level ($1.25m \leq x \leq 1.5m$) around the bole of the tree, the presence (1 = present, 0 = not present) of epicormic branching, and the presence (1 = present, 0 = not present) of woodpecker activity. Epicormic branches are small lateral branches produced along the lower portion of tree trunks often in response to stress. Woodpecker activity increases on ash trees in the presence of EAB larvae, and symptoms are observed as bark flecking or small areas with missing bark.

Table 4. Ash tree condition for each reservation based on EAB indicator characteristics including average size (dbh), canopy condition and the number of trees showing external symptoms of EAB infestation (number of EAB exit holes, epicormic branching and woodpecker damage).

| Res. Code | # Ash trees | Species | Avg. dbh (cm) | Avg. Crown Rate | # EAB exit holes | Epicormic branching | Woodpecker flecking/ damage |
|-----------------|-------------|-----------------------------|---------------|-----------------|------------------|---------------------|-----------------------------|
| South Chagrin | 4 | 2 Green, 2 White | 21.6 | 2.2 | 0 | 1 | 1 |
| Rocky River | 10 | 3 Green, 7 White | 30.5 | 1.7 | 0 | 1 | 0 |
| North Chagrin | 7 | 1 Green, 2 White, 4 Pumpkin | 30.2 | 1.7 | 0 | 0 | 2 |
| Mill Stream Run | 17 | 14 Green, 3 White | 33.7 | 2.4 | (1) on white | 1 | 5 |
| Hinckley | 43 | 16 Green, 17 White | 21.4 | 1.5 | 0 | 6 | 2 |
| Bradley Woods | 1 | White | 21.1 | 2.0 | 0 | 0 | 0 |

| Res. Code | # Ash trees | Species | Avg. dbh (cm) | Avg. Crown Rate | # EAB exit holes | Epicormic branching | Woodpecker flecking/damage |
|------------------|--------------------|----------------|----------------------|------------------------|-------------------------|----------------------------|-----------------------------------|
| Brecksville | 1 | White | 36.2 | 3.0 | 0 | 0 | 0 |
| Bedford | 22 | All White | 22.1 | 2.7 | 0 | 10 | 5 |
| Big Creek | 18 | All Green | 23.2 | 2.2 | 0 | 7 | 2 |
| West Creek | 2 | All Green | 16.2 | 1.5 | 0 | 0 | 0 |

Ash trees are affected by numerous insects and disease causing organisms as well as stress factors such as drought and physical damage; therefore, crown condition ratings are influenced by factors other than EAB. EAB exit holes, while proof of EAB presence, are usually symptoms at later stages of an infestation, especially when present at eye level. Absence of EAB exit holes does not necessarily indicate that EAB is not present at a particular location. Presence of epicormic branching and especially woodpecker activity (flecking) are considered better early detection methods for EAB presence.

Average crown condition of ash trees sampled indicates that trees are generally in good condition supporting the assumption that we are in the initial stages of the EAB infestation. Lower average ratings are noted in Brecksville and Bedford reservations. Bedford, Big Creek and Hinckley reservations had several trees with epicormic branching, and Bedford and Mill Stream Run reservations showed the highest number of trees with woodpecker damage.

In another effort to identify the presence of EAB, ten purple prism traps were deployed in 2010 as part of a collaborative research project with the U.S. Forest Service (Table 5). These traps, which have been used extensively to track the movement of EAB since 2004 throughout the North Central and Northeastern U.S., were placed near permanent research plots in forest stands with large ash components. Two traps located near the Willow Bend Picnic Area in Rocky River Reservation caught eight of the ten adult beetles captured during the year. The remaining beetles were caught in Bradley Woods Reservation (1 EAB) south of White Oak Lane and in Brecksville Reservation (1 EAB) near the Deer Lick Cave pull-off. Absence of captures does not imply that EAB is not present.

Table 5. Adult EAB counts for purple prism traps placed in four reservations in 2010.

| Reservation | Trap # | Trap location GPS Coordinates | # EAB caught |
|--------------------|---------------|--------------------------------------|---------------------|
| Bradley Woods | EAB BW 01 | 41.4140700 -81.9578600 | 1 |
| Bradley Woods | EAB BW 04 | 41.4132900 -81.9632399 | 0 |
| Rocky River | EAB RR 01 | 41.3915612 -81.8693990 | 7 |
| Rocky River | EAB RR 02 | 41.3922200 -81.8709100 | 1 |
| Rocky River | EAB RR 03 | 41.4163416 -81.8750448 | 0 |
| Rocky River | EAB RR 05 | 41.4149120 -81.8759748 | 0 |
| Brecksville | EAB Br 01 | 41.3047450 -81.6091163 | 1 |
| Brecksville | EAB Br 02 | 41.3040073 -81.6101901 | 0 |
| North Chagrin | EAB NC 02 | 41.5825630 -81.4289482 | 0 |
| North Chagrin | EAB NC 05 | 41.5850196 -81.4299998 | 0 |
| Totals | | | 10 |

These and additional surveys by Natural Resources and Forestry Division personnel indicate that initial EAB infestations exist in Bradley Woods and Huntington Beach with larger infestations in Brecksville, Big Creek, Mill Stream Run, and Rocky River reservations (Figures 1 and 2). Visibly infested trees have been documented near the I-80/I-71 intersection along Big Creek Parkway, north along Valley Parkway through Rocky River, and especially along the Lake to Lake Trail. Positive EAB locations have been verified through the use of purple prism traps, observation of EAB exit holes, and larvae observed through bark scraping (Figure 1). Suspect EAB locations (trees with thinning canopy and woodpecker damage) are also noted on Figure 1. Currently there are no confirmed cases of EAB in other reservations; however, the incidence of woodpecker damage in Bedford, North Chagrin, and Hinckley reservations warrants more intensive observations in 2011.

INDIVIDUAL TREE AND ASH STAND MANAGEMENT PLAN AND BUDGET

Because the EAB infestation is an evolving and rapidly changing problem, only broad outlines of responses are possible at this time. It is expected that responses to this situation will be equally fluid and require frequent adjustments within and between years. Criteria for the removal of ash, which may include non-symptomatic trees occurs according to the Vegetation Management Program. To date, EAB infested ash have been managed using existing Forestry Division crews and within the existing, rotating schedule outlined in the Vegetation Management Program of Cleveland Metroparks (2005). The only exception to date was a proactive ash tree removal by forestry crews along portions of Big Creek Parkway in 2008. Once dead, ash trees decay quickly becoming brittle and more difficult to manage the longer they remain dead-standing. This poses increased safety risks to Park District staff that are responsible for dead tree removal. It is highly recommended to remove ash trees while they are still alive.

As of April 2011, EAB has been positively identified in nine reservations (Bradley Woods, Huntington, Rocky River, Mill Stream Run, Big Creek, Hinckley, Brookside, Brecksville, and South Chagrin). However widespread ash mortality is currently affecting the West Side reservations, especially Big Creek, Mill Stream Run, Rocky River and Brecksville where we are likely in year 3 or 4 of a large scale infestation. These reservations collectively account for nearly 40% of the ash trees surveyed in high use areas in 2007 (Table 1). Other reservations with high ash estimates may need to be addressed sooner depending on ash mortality rates including Brecksville where EAB is rapidly expanding. Large scale, observable mortality should become visible in the next 2-3 years, given the documented patterns of ash decline following EAB colonization (Knight 2008). If this occurs, program costs will be front-loaded, with higher costs realized earlier and then declining as removal efforts move into areas of the Park District with fewer overall ash trees.

Approximately 8,000 trees need to be removed from the Park District's developed public-use areas (DPUA) and other borders. The DPUA including picnic areas, golf courses, parkways/parking lots, all purpose trails (APT), and the zoo. Other borders include residential/commercial property lines, and trees that are outside of the right-of-way of roads that are managed by other agencies. This number is based on 3,953 trees identified while surveying picnic area and golf courses in 2007 (3953 trees) plus another 4000 trees expected to exist in areas not surveyed in 2007 (parkway, APT, and property line borders, for example). Cleveland Metroparks expects to use **multiple management strategies** to deal with dead and dying ash trees. Within each management strategy several assumptions are made as part of the current plan.

- 1) Conduct annual assessments on or about mid-June to determine priority areas for removal of ash trees in the identified high use areas.
 - Incorporate information from the Ash Mapping Project, which utilizes public volunteers to map ash tree density and distribution along the APT during winter months before leaf-out. This program also records the presence of woodpecker damage on the ash trees as a proxy for EAB presence.
- 2) Utilize Park District staff to remove ash trees.
 - Initial consultation concerning ash tree removal areas will include the appropriate Park Manager and Natural Resources Area Manager and a member of the Forestry Division.
 - A basic assumption is that Park District staff can remove a constant number of trees over 10 years (~600/yr). This helps keep annual costs down, but the pattern of infestation may require removal of more trees in west side reservations in the first years of this cycle.
 - Park District management staff are capable of handling smaller diameter trees (4-12" dbh), while the Forestry Division has the skilled personnel and equipment necessary for larger tree (≥ 13 " dbh) removal.
 - Chippers, stump grinders and various forestry trucks will need to be purchased, replaced, and/or upgraded to deal with the additional number of ash trees being removed by Park District staff each year.
- 3) Utilize contractors to remove ash trees.
 - Total tree removal exceeds current staffing capacity. A minimum of 2000 ash trees will need to be removed by contractors over the next 10 years.
 - Requires special equipment for large-scale tree removal operations that are located near DPUA (or other priority areas) and will require a "sensitive" removal process.
 - The Park District will periodically contract for tub grinding or whole-tree chipping of removed ash trees as needed when significant stockpiles of ash material accumulates.
 - As the EAB infestation becomes more widespread (expected in 2013), movement of EAB contaminated wood poses less threat to Cleveland Metroparks. However, movement of wood material should remain limited and relatively localized as patterns of EAB spread are not well understood to date. (see CM Firewood Policy for regulatory updates)
- 4) Upon receiving notice and whenever possible, restrict access or close trails where risk from dead or dying ash-dominated stands is high and trees cannot be safely removed or removal exceeds the financial or logistical resources of the Park District at that time.
 - Trail closures will be adequately marked and advertised.
 - Trail closures will be temporary until such time as risk can be reevaluated.

- 5) In public-use areas with notable ash loss, plant a combination of park-grade (2-3 in dbh) and large diameter (>5 in dbh) trees of preferred species.
 - In addition to park-grade trees, Cleveland Metroparks will plant ~200 large-diameter (>5 in dbh) trees over the next 10 years in public-use areas where special needs exist.

- 6) Chemically treat individual ash trees with recommended insecticides in high use and special natural areas.
 - The Park District will treat about 200 trees in high use/high visibility and natural habitat areas.
 - Average cost across various tree diameters is \$200 per tree.
 - Current insecticide recommendations (emamectin) require treatment every two years.

- 7) Restore ash dominated stands that are of high ecological value and/or in high visibility locations.
 - Approximately 400 acres will need to be actively managed. This is a guess at best, and will be better quantified in the next 12-24 months.
 - Probable need for understory tree planting.
 - Need for deer fencing or other measures to protect regenerating saplings whether they are planted or occur naturally.
 - Invasive species control will be necessary in highly disturbed areas.

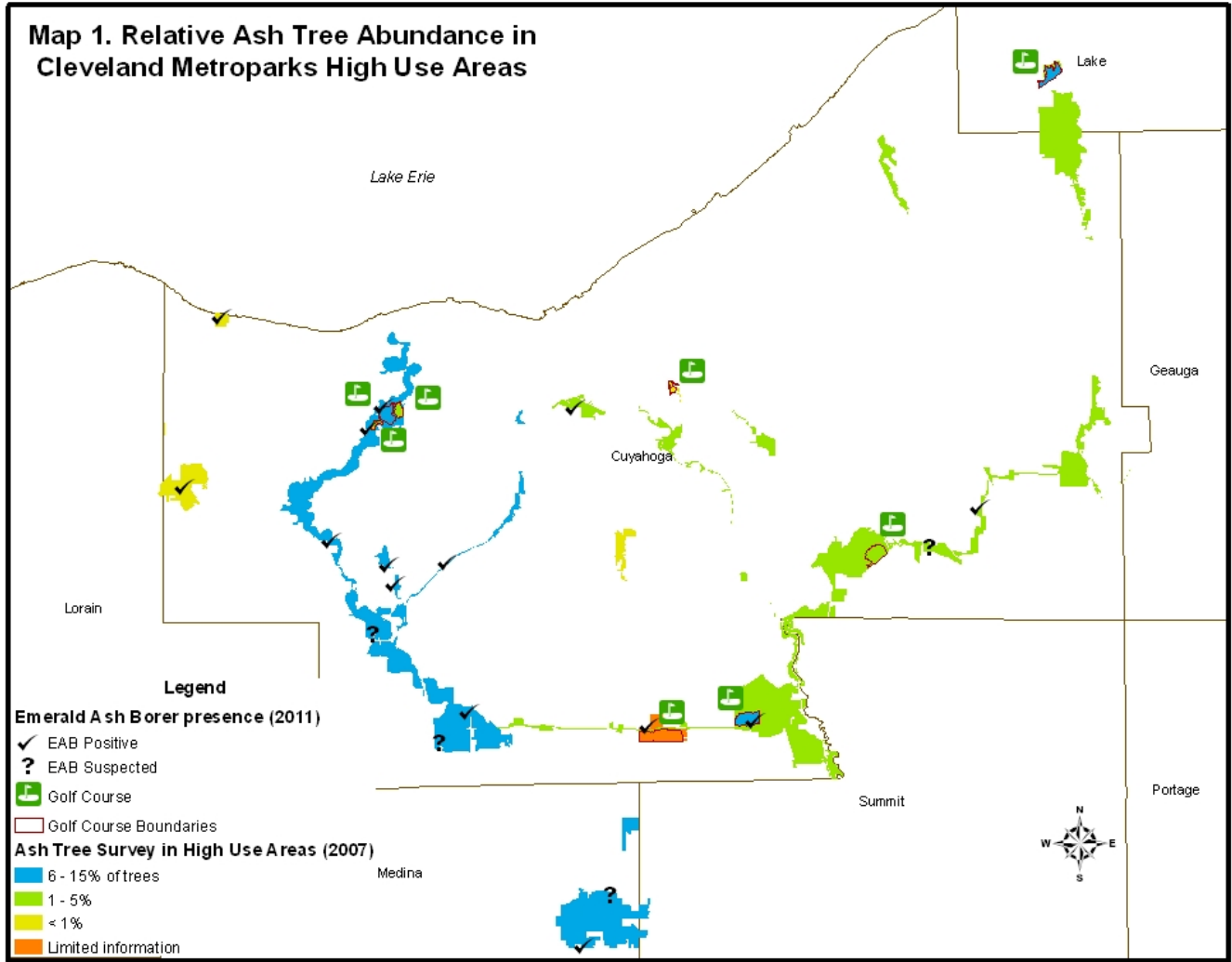
- 8) Various outreach and public relations efforts are needed.
 - Public and staff updates on the plan and on the progress of infestation and management – web, news releases, reports, establish an EAB summary to be posted on the website, with links to facebook.
 - Outdoor Education will deploy self-running DVD programs at each nature/visitor center and NatureTracks explaining EAB, symptoms, homeowner action, and potential impact (June 2011)
 - The Vegetation Research Coordinator will provide a second phase of in-service training for OE staff by visiting affected EAB sites. Assists with OE programming and answering visitor questions. (June-July 2011)
 - Training for CM staff on EAB management plan to enable educated responses to public inquiries concerning CM management of EAB (e.g., why ash trees are cut before visual signs of EAB)
 - Suggestions to property owners for dealing with EAB – links to information concerning insecticides, alternative tree species, risk
 - Public sensitivity: the emotional attachment to trees
 - Ways to volunteer – adopt a tree, tree planting, seed collection, inventories.
 - Provide an opportunity for public donations toward chemically treating trees or purchasing trees.
 - Reforestation efforts

- Nurture Nature program: use public volunteers or groups (schools, scouts etc.) to nurture tree seedlings and saplings over a period of time (months) until they are planted in a restoration area.

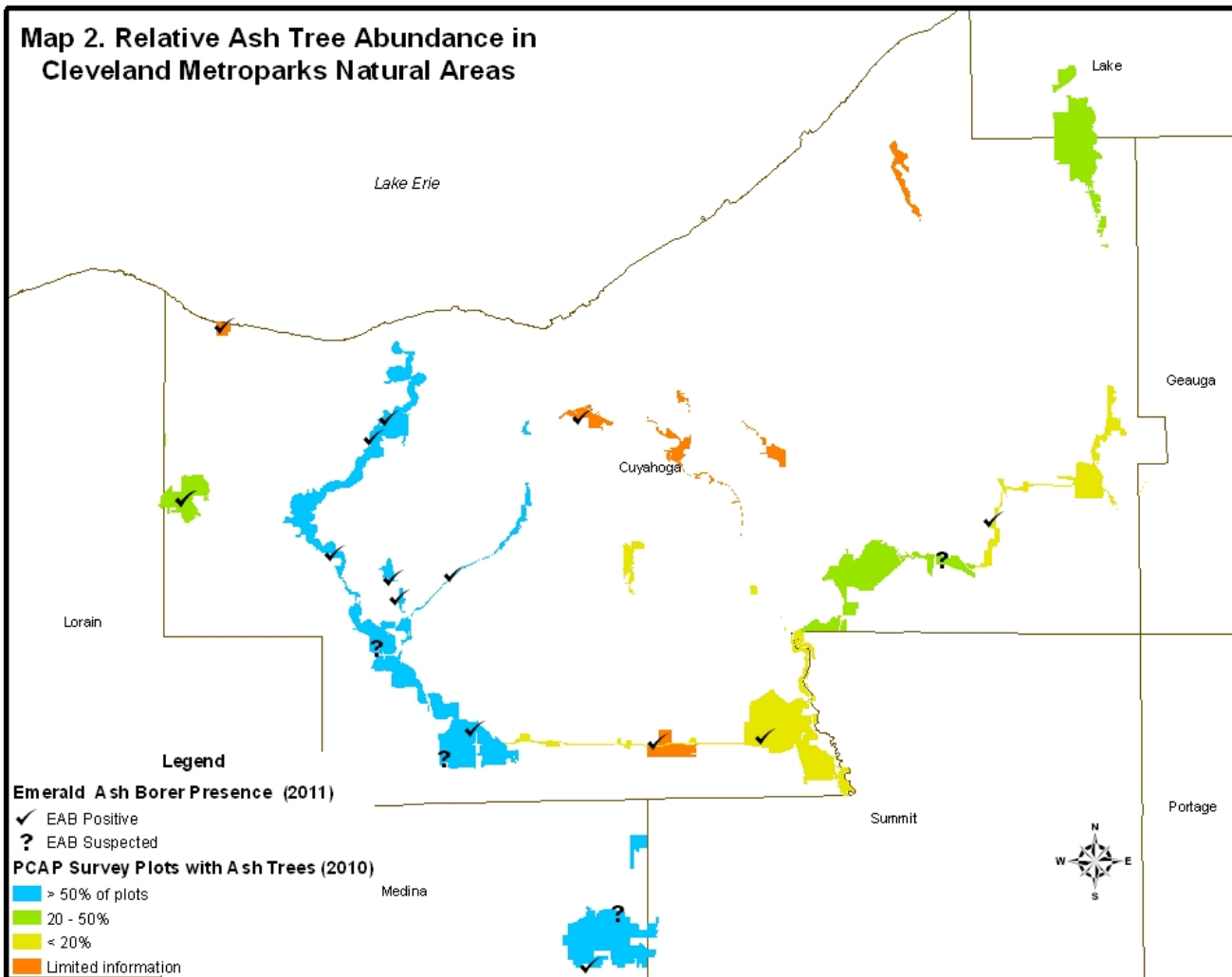
9) Research Collaborations for 2011

- Baldwin-Wallace College: 1) Purple Prism traps used to determine EAB population size, density, distribution, and emergence patterns; 2) transplanting and care for 350 seedlings to be used for reforestation.

Cleveland Metroparks set \$120,000 aside January 1, 2011 through December 31, 2011 to begin an EAB management program. These funds will be used for contract tree removal, chemical treatment of select ash trees, and purchase and propagation of replacement plant material. Depending on fiscal and logistical constraints, the mix of strategies employed can be adjusted. For example, less contractor removal may mean more in-house staff work, a more targeted approach to evaluating the trees that pose the most serious risk, and an increasing use of temporary closures, until trees can be removed or fall down on their own.



Note: Ash distribution is not uniform within a reservation. Color codes merely indicate ash abundance differences in high use public areas between reservations. (EAB presence as of April 2011)



Note: Ash distribution is not uniform within a reservation. Color codes merely indicate ash abundance differences in natural areas between reservations. (EAB presence as of April 2011)