Emerald Ash Borer Population Study

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Bay County Forest Sustainability Program

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Introduction

Emerald Ash Borer (*Agrilus planipennis*) was first detected in southeast Michigan and the neighboring Canadian province of Ontario in 2002, marking its initial discovery in North America. This species is believed to have arrived several years earlier, likely during the mid-1990s, through internationally traded wood packaging materials (Cameron, 2014). Native to Asia, Emerald Ash Borer has since caused extensive environmental and economic damage. According to the Arbor Day Foundation, an estimated 40 million native ash trees have died in the state of Michigan since the beginning of the invasion.

Photo courtesy of University of Maryland Extension

Ash trees have historically played an important role both economically and ecologically. Ash wood was used for furniture and flooring, and it was the ideal wood for baseball bats and tool handles. Ash trees are also critically important to the ecosystem and once provided forests with diversity. For example, black ash (*Fraxinus nigra*) is one of the only species able to withstand a high-water table in forested wetlands, and its population loss is theorized to have detrimental effects on wetland ecosystems (Robideau, 2022). Another example is that ash leaves are a highly valuable food source for frogs, as the tadpoles munch on the leaves as they fall in water sources, and the decline of ash has led to poor survivability rates for tadpoles (Stephens, J.P. et al., 2013). Economically, researchers estimate that the potential total costs per 1,000 residents was estimated to be between $395,943 and $769,687, and billions for individual states where the Emerald Ash Borer was present (Sydnor et al., 2007). By the time

Emerald Ash Borer was officially detected, populations were already well established, allowing the insect to spread rapidly throughout Michigan.

Adult Emerald Ash Borers typically begin emerging from infested trees in mid to late May, chewing out D-shaped exit holes in the tree when they are ready to leave. In Michigan, peak emergence generally occurs between mid to late June (Brown-Rytlewski and Wilson, 2005). Once they emerge, they will chew on the leaves of ash trees, and once adjusted they will begin searching for mates. Adults have a lifespan of approximately three to four weeks, during which reproduction occurs. Females will lay approximately 60-100 eggs after mating, and the female will lay these eggs on the crevices of the bark of an ash tree. About a week later, the larvae will emerge from their eggs, and begin to find their way underneath the bark, where they will begin feeding on the nutrient-rich vascular tissue of the ash tree until they overwinter (New York Invasive Species Information, n.d.). This larval feeding disrupts water and nutrient transport within the tree and is the primary cause of ash mortality. Common indicators of infestation include canopy dieback, epicormic branching, bark splitting, and increased woodpecker activity resulting in bark removal.

Since the Emerald Ash Borer made its way through Michigan over the last two decades, there has been little research on their post-invasion population numbers and management techniques. In Bay County, Michigan, Emerald Ash Borer was first detected in 2007. The Bay County Gypsy Moth Suppression Program, or what is now referred to as the Forest Sustainability Program, developed a management plan to protect nearly 3,000 publicly owned ash trees from the fatal damage of the Emerald Ash Borer. The program could not treat the publicly owned ash trees until 2011 because the insecticide was not federally regulated yet. After 2011, the ash trees began to be treated with emamectin benzoate (TREE-äge), an insecticide that protects the trees for up to three years from the harmful effects of the Emerald Ash Borer. Under this management strategy, approximately 1,000 ash trees are treated annually on a rotating three-year cycle (McCullough et al., 2011).

Although a large majority of the untreated, mature ash trees have been killed off in Bay County, staff have always assumed that Emerald Ash Borer remained in the county, taking

advantage of the young ash in forests, along ditches, or near the Saginaw Bay. While residents were informed that Emerald Ash Borer was still present in the area, there was no recent research or studies confirming their continued activity in the area. As a result, program staff would talk to many members of the public who believed the Emerald Ash Borer had left the local environment because of the ash tree decimation. This project was developed to provide insight and clarification on the post-invasion numbers of the Emerald Ash Borer in Bay County, and to contribute data which supports the continued use of millage funds to treat the publicly owned ash trees that line the streets and fill the parks of Bay County.

Methods

Because of the nature of the millage-funded Forest Sustainability Program, staff were only able to access sites that are publicly owned on a local level that contain ash trees. Sites were selected based on a higher proportion of green ash (*Fraxinus pennsylvanica*) relative to white ash (*Fraxinus americana*), due to the Emerald Ash Borer's documented preference for green ash (Anulewicz et al., 2007). Preference was given to locations that contained both treated and untreated ash, or at least a high predictability that young regenerative ash would be in the area. This was assessed by looking at aerial imagery and understanding the local geography from program monitoring efforts. Staff also distributed traps in different areas of the county to compare population differences based on location and environment.

Emerald Ash Borer trapping mechanisms previously used in Michigan were thoroughly researched prior to this study. From the findings, double-decker traps yielded the best results (Poland et al., 2011), but within the means of the program this was too difficult of a trap to make due to transportation and monetary restraints. For the purposes of this study, the three-sided green prism canopy trap was chosen, as they have demonstrated effective Emerald Ash Borer capture rates in previous studies (Poland et al., 2019). Each trap was coated with Pestick, a sticky adhesive designed to capture insects upon contact. Traps were baited with cis-3-hexenol lures obtained from Synergy Semiochemicals, which were attached to the trap hangers using fishing line (Poland et al., 2019).

Trap installation was conducted using 1/8-inch arborist throw line and a throw weight, which was cast over selected branches suitable for trap placement. Once the weight and rope went over the branch and returned back to the ground, the throw weight would be taken off, and a hanger would be positioned onto the top of the trap. Once this was done, the trap would be raised back up into the canopy using the rope. After installation, the rope length required for safe trap retrieval was measured, cut, and secured by wrapping the remaining slack around the tree trunk. After this first week, there was a quick realization that anchor ropes were needed to keep the traps from spinning and tangling the rope in the wind. To combat this, anchor ropes were installed from the bottom holes of the trap to the base of the tree. This meant that there

were two independent rope systems for each trap. Without attaching anchor ropes, there would be a substantially higher risk for traps to become entangled and stuck in the tree canopy.

Most of the traps were deliberately placed in areas where the trap would receive direct sunlight, as previous research indicated that sunny sites can increase Emerald Ash Borer capture rates (McCullough, D. G., et al., 2009a). Trap locations had slightly different logistics and environments. During June and early July of 2023, only one lure was used at all sites except Pinconning Park. Midway through the season, a second lure was added to most traps to maintain volatile freshness and effectiveness. Pinconning Park was the only site in 2023 that utilized more than one lure (Pinconning Trap's A and B had two lures, and Trap C had three lures). In 2024 and 2025, all traps were deployed with two lures at the start of the season, and these lures remained in place until trap removal.

For each season, trap setup was targeted for the first week of June, and trap removal happened during the last two weeks of August.

At each site, a small laminated sign labeling the project area and program's contact information were placed on nearby trees, and these signs were taken down the same time the traps were.

Examples of green prism canopy traps in ash trees:

Garfield Township Hall Site

Bentley Ballpark Site

The trees were also rated on a scale of 1-5, using a reliable protocol the Forest Sustainability Program has created in years past to assess the health of the ash trees within the treatment program. A tree with a rating of one is a healthy tree with no symptoms of stress or EAB attack. A tree rated as a two indicates small levels of stress, like slight canopy thinning, bark damage, or a few epicormics. A tree rated a three indicates there is canopy dieback, with some dead limbs that are not caused by shading, as well as possibly more bark damage or epicormic sprouts. A tree rated as a four indicates that there is less than 50 percent of a full canopy, and/or many epicormic sprouts and bark damage. A tree with a rating of five means the tree is extremely stressed and the canopy has little to no foliage, which may be classified as a dead canopy.

Trap Locations

Bentley Park

This trap site was selected due to the presence of large ash trees showing slight decline that are treated by the Forest Sustainability Program within the park. Stressed ash trees release volatiles that attract EAB (Emerald Ash Borer) more effectively than healthy ash trees (Selvaggio, 2022). EAB adults can specifically identify ash canopies among surrounding tree species, and the ash trees at this site are clustered and more mature than those found at other locations in the county. The area surrounding the village of Bentley in Gibson Township is one of the most forested parts of Bay County, indicating that the potential for regenerative ash in the area would be significantly greater compared to the agricultural areas further south within the county. Two of the three traps were placed high within the tree canopies and were fully exposed to sunlight. The remaining trap was installed in a smaller ash tree located near a basketball court at the site. Following the first two years of trapping, Trap B was slightly adjusted to a few ash trees over to avoid construction activities within the park.

Pinconning Park

This trap site offered the greatest number of favorable conditions among the sites surveyed. It contained a high density of treated ash trees located in close proximity to the canopy traps, with a total of 66 treated trees present. Tree health varied across the site, with some ash trees in excellent condition and others showing signs of decline.

A large stand of untreated, young green ash was identified between the playground and the parking lot at this site, separated by a small wooden boardwalk. This ash stand is where the traps were placed. Most of these trees appeared to be in relatively good health, though some exhibited visible Emerald Ash Borer (EAB) damage. Additionally, a lowland area behind the park's garage contained a substantial number of dead standing ash trees from years past, further indicating a once well-established EAB presence at the site.

This is also the only site where staff girdled three untreated ash trees in an effort to help attract the EAB beetles to the traps, and to debark the trees in autumn to see if there were any larvae present (McCullough et al., 2009b). During debarking, evidence of a fresh larval gallery was observed on one tree, although no larvae were found.

In 2023, during the year that the ash trees were girdled, the Pinconning prism traps at this specific site were equipped with a greater number of lures compared to the rest of the sites. One trap contained three lures, while all traps initially had two lures at the start of the season. Due to site conditions and the expectation that EAB would be difficult to capture, program staff initially identified Pinconning Park as the most promising site for EAB detection. This resulted in the use of additional lures and the implementation of girdling. Overall, multiple factors combined to make this site the most attractive for EAB activity.

Garfield Township Park

This trap site contained a few mature, treated ash trees that were under the health rating category of 3. These trees were evenly spaced, allowing for the placement of three traps in a triangular arrangement. Similar to the Bentley site, aerial imagery indicated that the surrounding area contained extensive wooded habitat with a high potential to support regenerative ash. Regenerative ash was also observed on the southwest edge of the property near Trap C.

Frankenlust Township

Frankenlust is a major agricultural township, but there are wooded sites intermingled in between the farm fields. A defining factor for choosing this site was the Dutch Creek waterway as well, due to the fact that ash trees thrive in wetland areas and along floodplains. The township park, where the traps were installed, was selected because the ash trees appeared more stressed than the county's typical treated ash trees, which likely increased their attractiveness to Emerald Ash Borer (EAB).

The selected trees were located in an open area with full sun exposure. This site also contained some of the highest trap placements in the county, with the only comparable height occurring at Trap C in Garfield Township. Following the first year of sampling, Trap C in Frankenlust was relocated due to the dense branching structure of the original tree, which made trap removal and seasonal maintenance difficult. Maps from both years are provided under Location Photos.

Golf Course

The Bay County Golf Course contains some of the densest and most extensive clusters of treated ash trees in Bay County. Approximately 70% of the trees on the course are ash, and without the Forest Sustainability Program's treatment efforts, the site would not retain its current condition. Nearly all ash trees at this location fall within health ratings 1, 2, or 3.

In the vicinity of Hampton Township, regenerative ash is commonly found in drainage ditches, along with numerous untreated ash trees along the Saginaw Bay shoreline. Within the golf course itself, plenty of untreated ash is visible along road edges and drainage systems. Traps A and B (see map) were placed in small untreated green ash trees on the edge of hole fourteen of the golf course. The last trap was placed in a treated white ash towards the end of the same hole fourteen. The golf course site was only used during the first two years of the study and was subsequently replaced by Finn Road Park due to consistently low Emerald Ash Borer (EAB) capture numbers.

Fraser Township Hall

This site, near the village of Linwood, was used for the 2024 and 2025 seasons. At the northern edge of the property, a single mature, treated ash tree was present and was selected for Trap C. On the opposite end of the property towards the south end, next to Mackinaw Road, sits several large, untreated ash trees that exhibited clear signs of stress; these trees were used for

Traps A and B. Based on previous research, staff was also aware that open forest edges and direct sunlight was beneficial for EAB catch results (Cladas, 2016). Trap A was installed in one of the tallest trees that a prism trap was placed in during this study. Fraser Township consists of a mix of agricultural land and wooded areas, allowing regenerative ash to remain prevalent in the vicinity of the trap site.

Williams Township Park

Williams Township Park was another site added later in the 2024/2025 seasons, similar to Finn Road Park and Fraser. This site was located in the city of Auburn, only a few miles away from the Midland County border. The total number of treated ash trees in the park is currently 42 trees. Although this portion of the county is predominantly agricultural, inclusion of this site allowed data collection in the southwestern region of the county, ensuring broader spatial coverage across the study area. All of the trees in the park were their own defined edge as well, with open fields and parking lots bordering the park property, which made the tree canopies significantly more attractive by standing in direct sunlight (McCullough et al., 2009a).

Finn Road Park

Finn Road Park served as the successor site to the Bay County Golf Course. Located just a few miles from the former golf course site, Finn Road Park sits along the Saginaw Bay shoreline. This park has extensive trails to the west and east of its location, as well as a general park area and campground that has 58 treated green and white ash trees. The trail corridors support a high density of untreated ash trees, some with diameters at breast height (DBH) exceeding 15 inches and exhibiting full canopy health. Towards the end of the eastern trail on the edge of the property is where the prism traps were placed. Three smaller untreated ash trees were chosen for the traps and were placed deep enough off the trail that there would be no hindrance to any park visitors.

Plot Data

Due to the nature of the sites being treated ash trees and public properties, as well as the widespread population crash of ash trees, sites with ash trees evenly placed were unavailable. Because of these limitations, it was not possible to create equal distances from the trap trees, and thus equal plot data. To try and capture the amount of cumulative ash DBH that were in the vicinity of the trap trees, staff recorded all treated ash DBH in a 120-meter circular plot from each trap location. Untreated ash was witnessed at every site in either small or large quantities, but was largely unmeasurable due to where they were located (in thickets, private property, swampy areas, etc.), so only treated ash was measured outside of the trap trees themselves.

Ash trees are measured by DBH, or "Diameter at Breast Height."

DBH is measured in inches and is rounded up to the nearest inch.

Traps acted as the center of the 120-meter circle plots. All treated ash within the Forest Sustainability Program had their DBHs measured and their sum was added inside of these areas. Non-treated ash and other tree species were not measured unless they were used for traps.

Treated ash sum DBHs inside these plots goes as follows:

Bentley Ballpark: 300 inches of cumulative DBH, including trap trees. Tree species in the surrounding area include: Maple and oak.

Bentley Trap A DBH ('23 - '24)	Bentley Trap B DBH ('23 - '24)	Bentley Trap C DBH ('23 - '24)
27 Inches	45 Inches	29 Inches

Bentley Trap A DBH ('25)	Bentley Trap B DBH ('25)	Bentley Trap C DBH ('25)
27 Inches	22 Inches	29 Inches

Pinconning Park: 692 inches of cumulative DBH. The DBH of the three untreated trap trees are labeled below. Tree species in the surrounding area include: Maple, willow, box elder.

Pinconning Trap A DBH	Pinconning Trap B DBH	Pinconning Trap C DBH
5 Inches	4 Inches	6 Inches

Garfield Township Hall: 258 inches of cumulative DBH. Tree species in the surrounding area include: Maple, oak, black cherry, birch, white pine, hemlock, beech.

Garfield Trap A DBH	Garfield Trap B DBH	Garfield Trap C DBH
26 Inches	20 Inches	29 Inches

Frankenlust Township Hall: 178 inches of cumulative DBH. Tree species in the surrounding area include: Box elder, maple.

Frankenlust Trap A DBH ('24)	Frankenlust Trap B DBH ('24)	Frankenlust Trap C DBH ('24)
21 Inches	28 Inches	14 Inches

Frankenlust Trap A DBH ('25)	Frankenlust Trap B DBH ('25)	Frankenlust Trap C DBH ('25)
21 Inches	28 Inches	37 Inches

Bay County Golf Course: 511 inches of cumulative DBH. The DBH of the two untreated ash trees were: 6 inches for A, and 6 inches for B. Tree species in the surrounding area include: Honey locust, sycamore, and maple.

BC Golf Course Trap A	BC Golf Course Trap B	BC Golf Course Trap C
6 Inches	6 Inches	13 Inches

Finn Road Park: 0 inches of cumulative DBH (but 58 treated ash trees in the nearby vicinity, 1149 cumulative inches of DBH). Other trees include: White oak, maple, willow, and box elder.

Finn Road Park Trap A ('24)	Finn Road Park Trap B ('24)	Finn Road Park Trap C ('24)
7 Inches	5 Inches	3 Inches

Finn Road Park Trap A ('25)	Finn Road Park Trap B ('25)	Finn Road Park Trap C ('25)
5 Inches	8 Inches	6 Inches

Fraser Township Hall: 27 inches of cumulative DBH. Two untreated DBH measurements with traps are Trap A at 24 inches and Trap B at 17 inches. Trees in the area include: Oak, black cherry, maple, poplar, and birch.

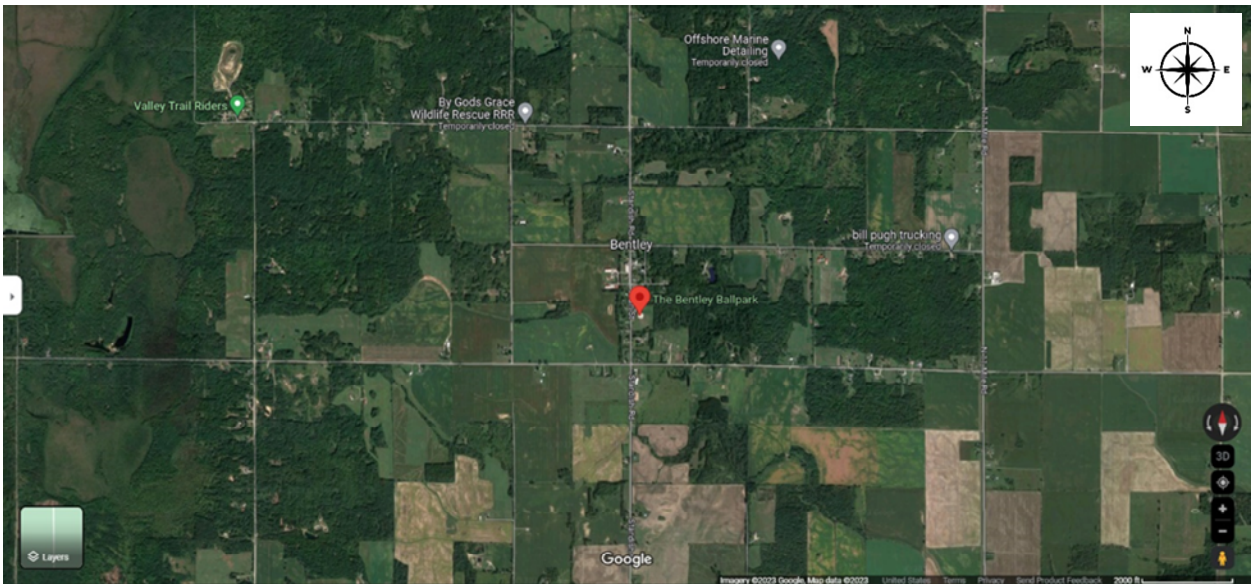
Fraser Trap A DBH	Fraser Trap B DBH	Fraser Trap C DBH
24 Inches	17 Inches	27 Inches

Williams Township Park: 483 inches of cumulative DBH of treated ash (Entire park at 734 inches DBH). Other trees in the area include: Norway maple, elm, and many horticultural trees.

Williams Trap A DBH	Williams Trap B DBH	Williams Trap C DBH
16 Inches	12 Inches	20 Inches

Location Photos

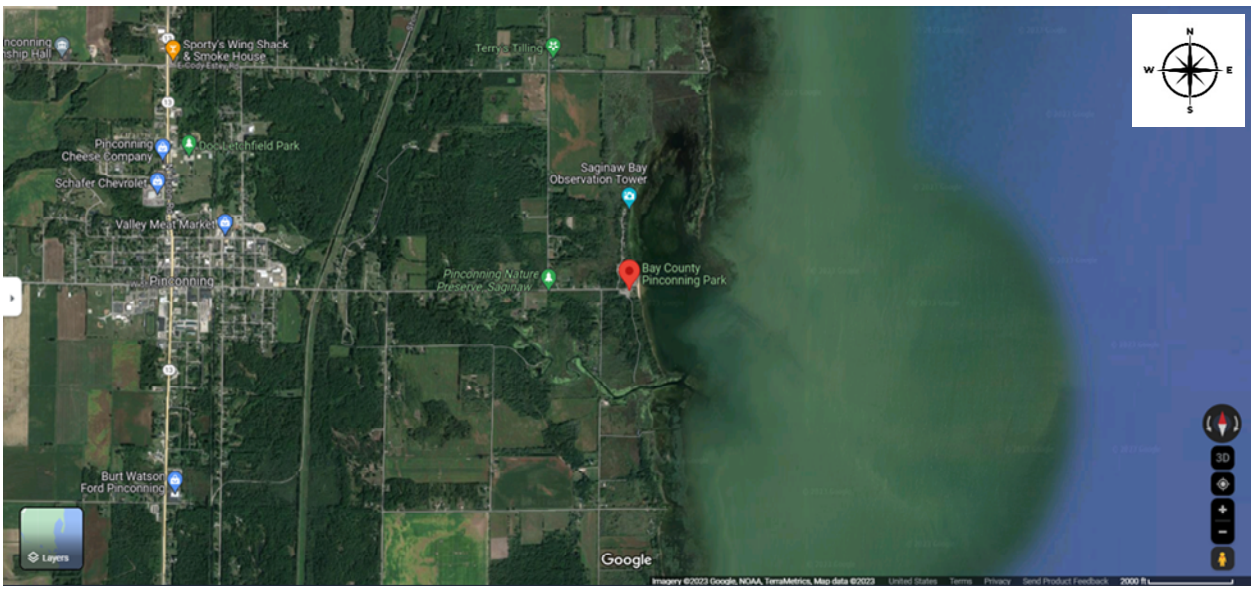
Bentley Ballpark: Gibson Township, Bay County. On Standish Road



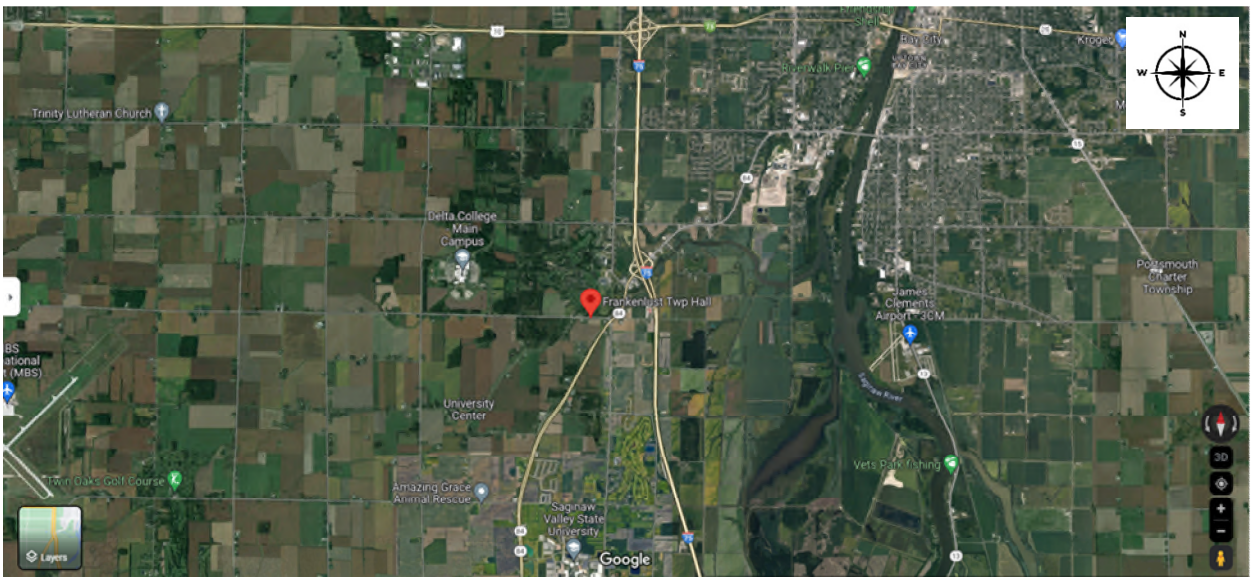
Bentley Ballpark 2023 - 2024

Bentley Ballpark 2025

Pinconning Park: Pinconning Township, Bay County. At the end of Pinconning Road



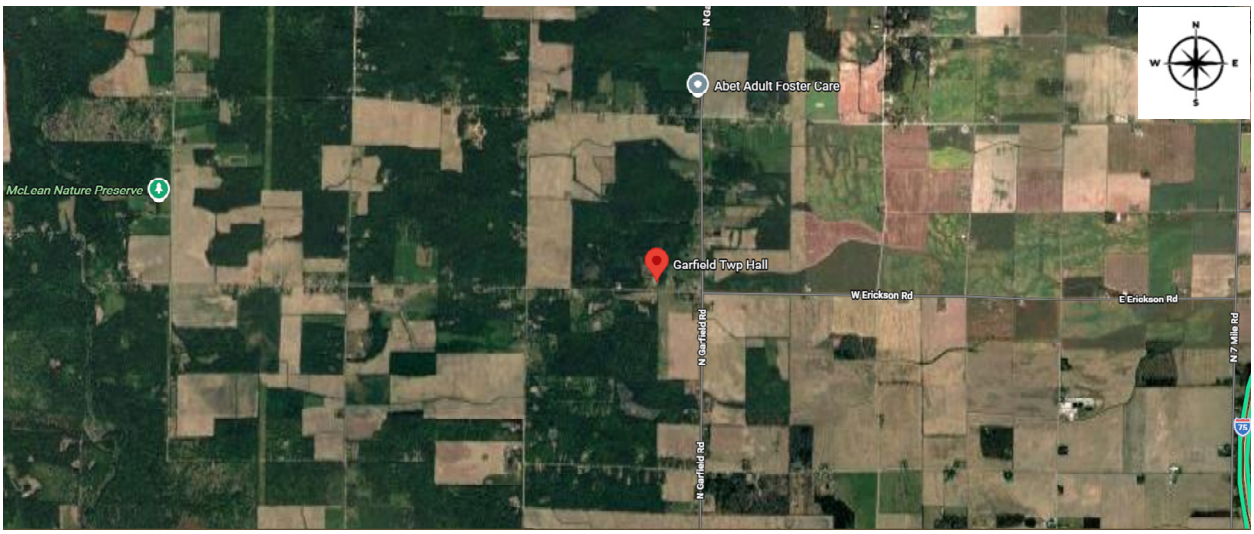
Frankenlust Township Hall: Frankenlust Township, Bay County. On Delta Road

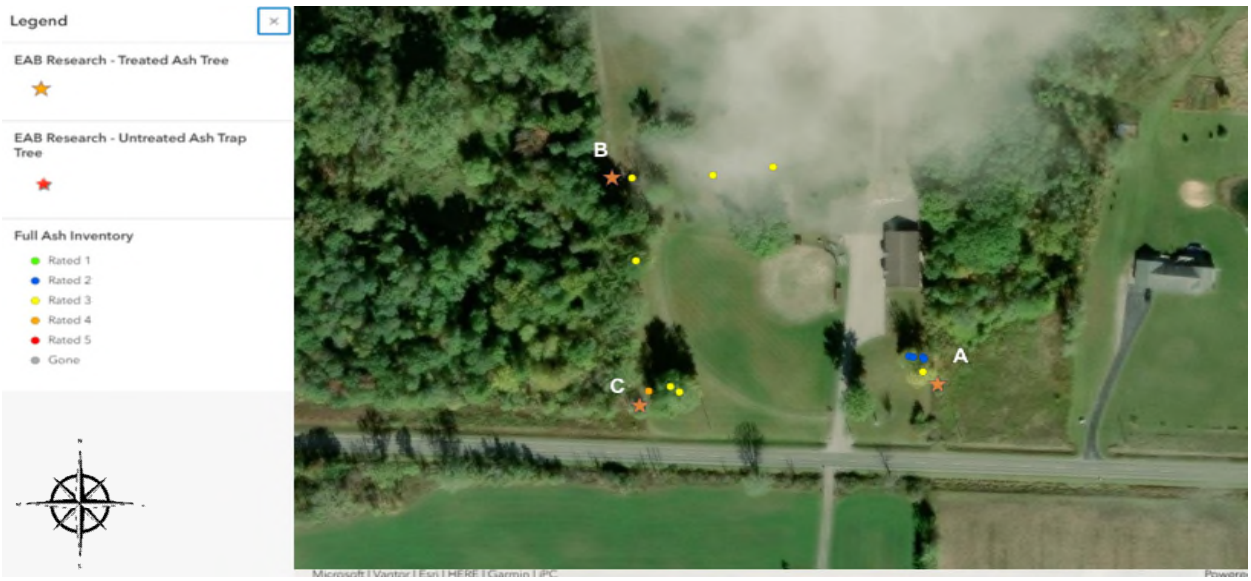


Frankenlust Township Hall 2023

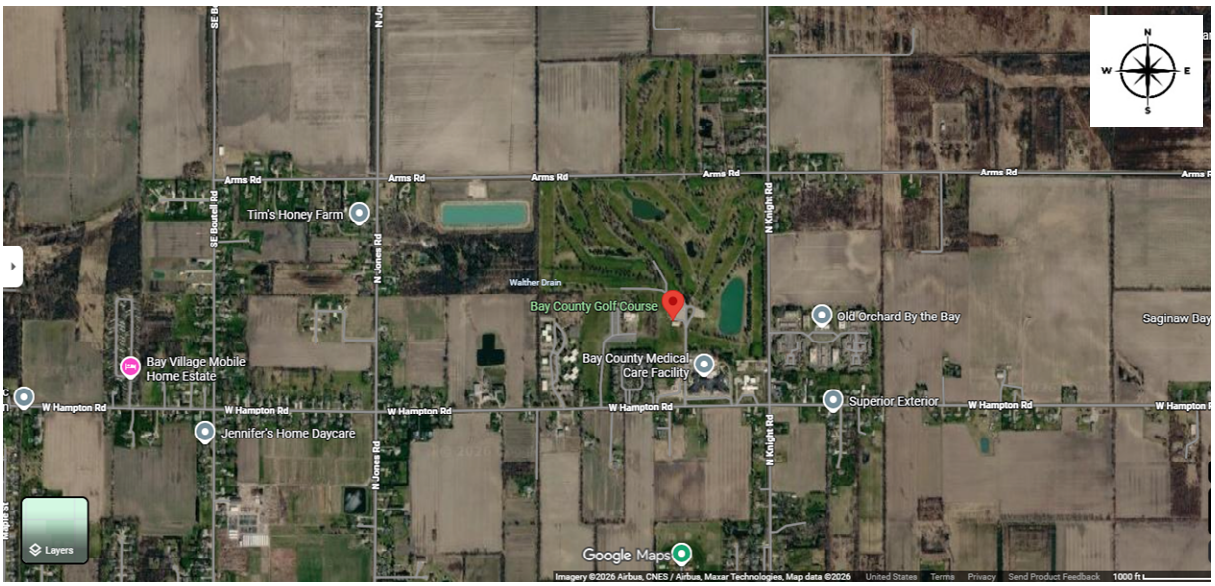
Frankenlust Township Hall continued, 2024 - 2025

Garfield Township Hall: Garfield Township, on Erickson Road



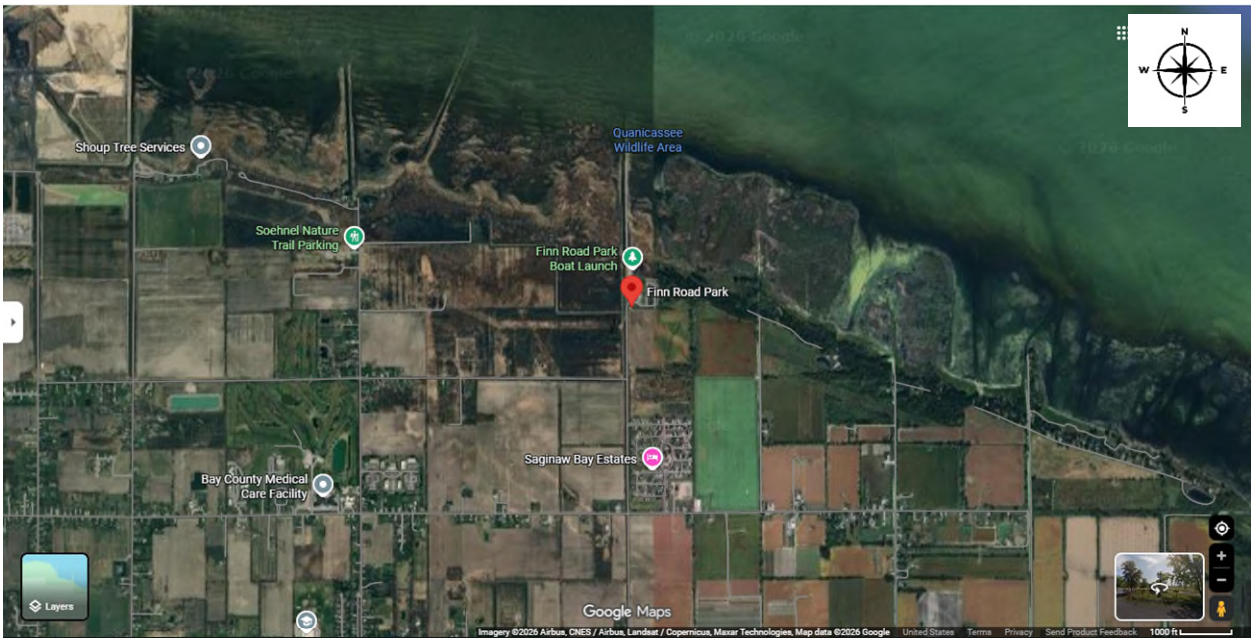


Bay County Golf Course: Hampton Township, Bay County. On W Hampton Road



Bay County Golf Course Holes 12, 13, 14, 15

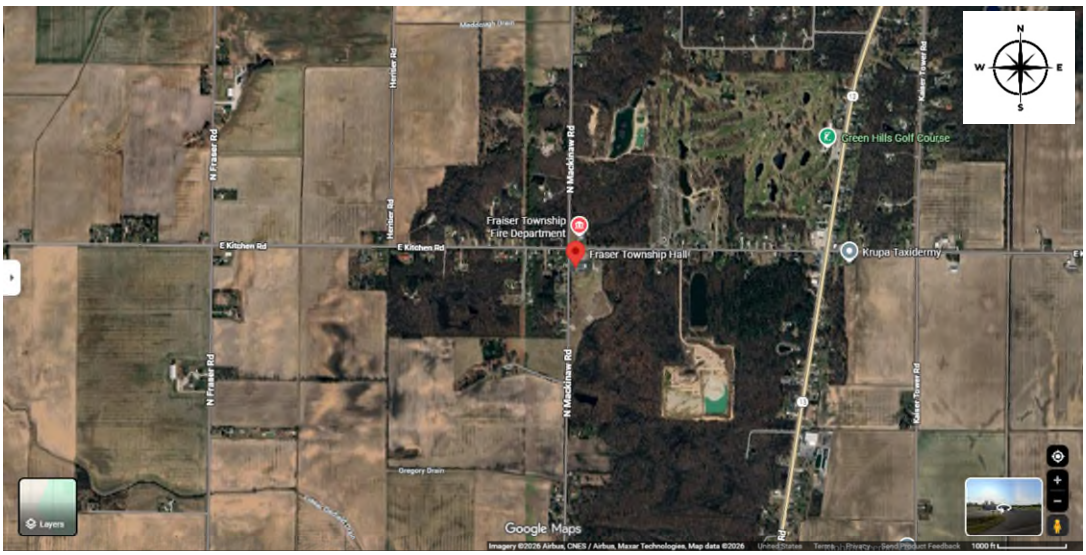
Finn Road Park: Hampton Township, Bay County. At the end of Finn Road



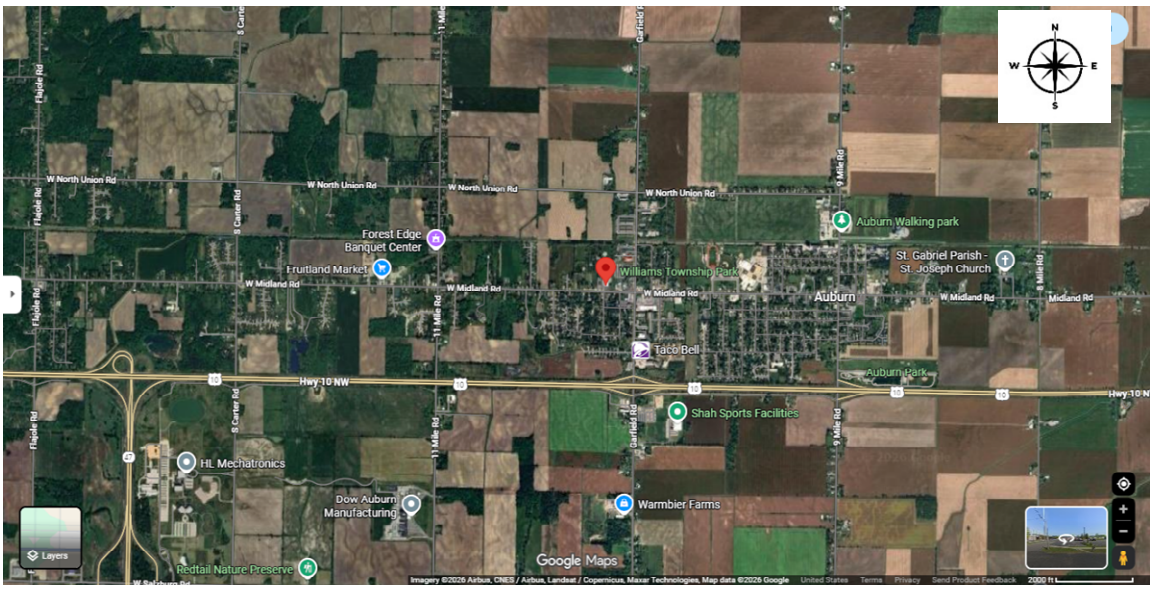
Finn Road Park 2024

Finn Road Park Continued, 2025

Fraser Township Hall: Fraser Township, Bay County. Crossroad of Mackinaw and Kitchen Road



Williams Township Hall: Williams Township, Bay County. On Midland Road



Results

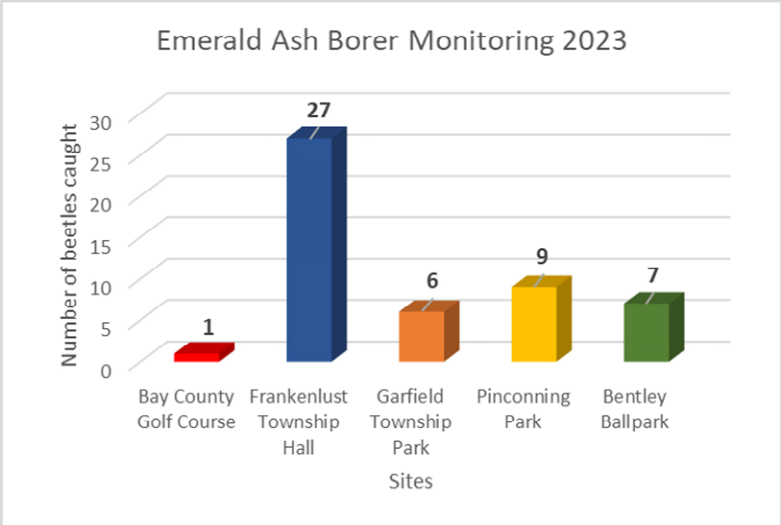
2023: During the first year of trapping in 2023, a total of 50 Emerald Ash Borer (EAB) beetles were captured over a three-month season using 15 traps placed across five locations. Traps were installed during the third week of June and removed at the end of August. Of the 5 trap locations, all of them were able to catch at least one Emerald Ash Borer, but not all traps caught them. For the 15 traps, there was an 80 percent catch rate for the traps.

Frankenlust Township Park traps caught the largest number, with a total of 27 EAB beetles caught. The Bay County Golf Course caught the least number of Emerald Ash Borer with a total of 1 beetle caught. Frankenlust Township Park traps caught 54 percent of the beetles overall, a significant portion of the total number caught. Of the traps at Frankenlust, Trap B caught 59 percent of the site catch percentage, with a total of 16 beetles caught on a single trap. The month of July did better than June or August for catch rates overall.

Garfield, Bentley, and Pinconning trap sites performed similarly to each other in regard to total amount caught. The traps in Pinconning were all placed in untreated, young ash trees, so the traps were not high off the ground. The trap that did the best in this location was Trap A, which had the most direct sunlight out of the three. The total caught for Pinconning was 9.

In Garfield, Traps A and B were placed mid canopy, while Trap C was placed high in the canopy. All of them were in direct sunlight, and all of the traps performed similarly. The total caught in Garfield was 6 beetles.

For Bentley, Trap A was lower to the ground, while traps B and C were higher in the mid-canopy of large, mature ash trees. Trap B performed slightly better in catch results, but not by a large margin. The total caught in Bentley was 7 beetles.



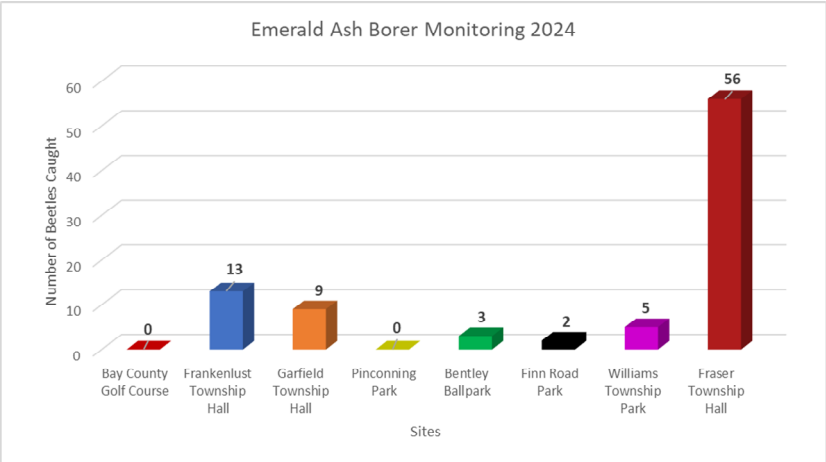
2024: During the 2024 season, there was a total of 88 Emerald Ash Borer caught. The prism traps were put up from the first week of June and taken down the last week of August. Due to the change in trees chosen for trap usage, “Trap A” at the Frankenlust site was now “Trap B.” This was due to difficulties removing the trap from the initial tree during weekly checks. An updated map is provided under the “Location Photos.”

2024 was the year of the highest number of sites, with eight different locations, meaning 24 prism traps were deployed. The new areas included Fraser Township Hall, Williams Township Park, and Finn Road Park.

In 2024, the only two sites that failed to catch a single Emerald Ash Borer was the Bay County Golf Course and Pinconning Park. In 2023, the golf course had only caught one, so this data established that the golf course, as well as the surrounding area of Hampton Township, did not contain a heavy population of Emerald Ash Borer. This was further confirmed by one of the new sites, Finn Road Park, which was just a few miles down road from the golf course along the Saginaw Bay. At Finn Road Park, only two Emerald Ash Borer were caught.

Fraser had the highest catch number of Emerald Ash Borer for the year 2024, comparatively to Frankenlust in 2023. Over the course of the summer, 56 beetles were captured at Fraser, especially traps A and B near the edge of Mackinaw Road. For the yearly total, Fraser accounted for over 60 percent of the beetles caught. In 2024, the Frankenlust site caught 13 beetles for the season.

Outside of the Frankenlust and Fraser sites, numbers were low across the board, such as Bentley Ballpark at 3 total EAB on the season, and the Williams Township site at 5. But just like last year, the tallest and windiest sites, such as Frankenlust and Fraser, garnered better numbers. For the Garfield site, 9 beetles were collected. Frankenlust and Fraser were some of the most open and sunny areas, and previous research shows these sites are favorable for Emerald Ash Borer (McCullough et al., 2009a).



2025: In the summer of 2025, a total of 112 Emerald Ash Borer were collected. Traps were put up in the first week of June and taken down the last week of August/first week of September. Everything was done the same comparatively to the 2024 season, other than the Bay County Golf Course site being removed from trapping efforts. After careful consideration from the last two seasons, it was determined that the golf course's capture rate did not provide enough data for the research to continue at this site for a third year.

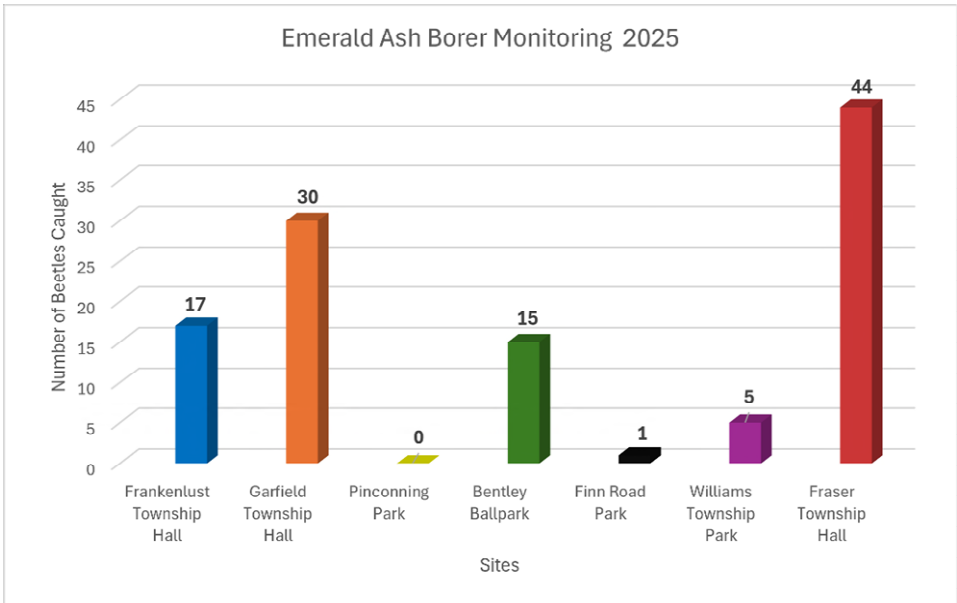
Similar to 2024, Fraser had the highest capture rate of Emerald Ash Borer at 44 beetles caught. All beetles caught were on two untreated ash trees near Mackinaw Road. Compared to the first two years of the study, Garfield had a significant increase in numbers to 30 beetles caught. Bentley also saw an increase in numbers with 15 beetles caught, compared to 3 from the previous season.

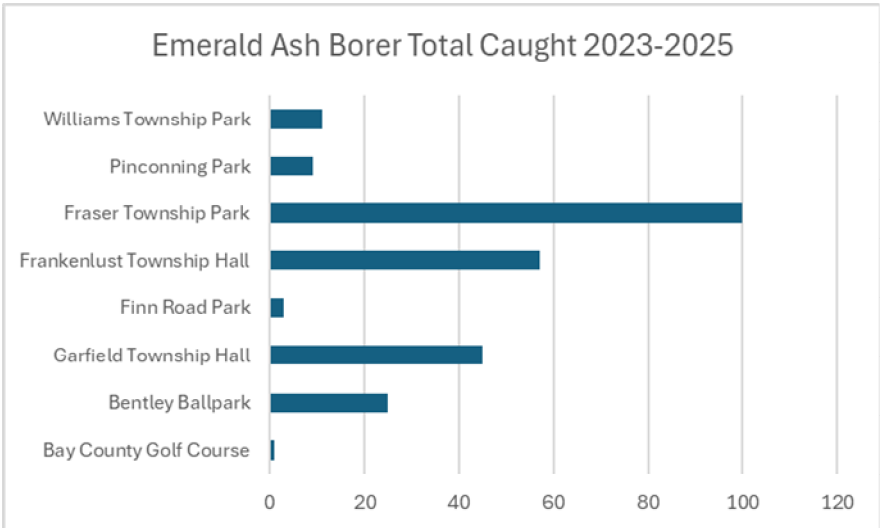
Pinconning Park also had a second year in a row that zero beetles were caught. Finn Road Park also only had a single beetle caught for the season. Frankenlust Township had an

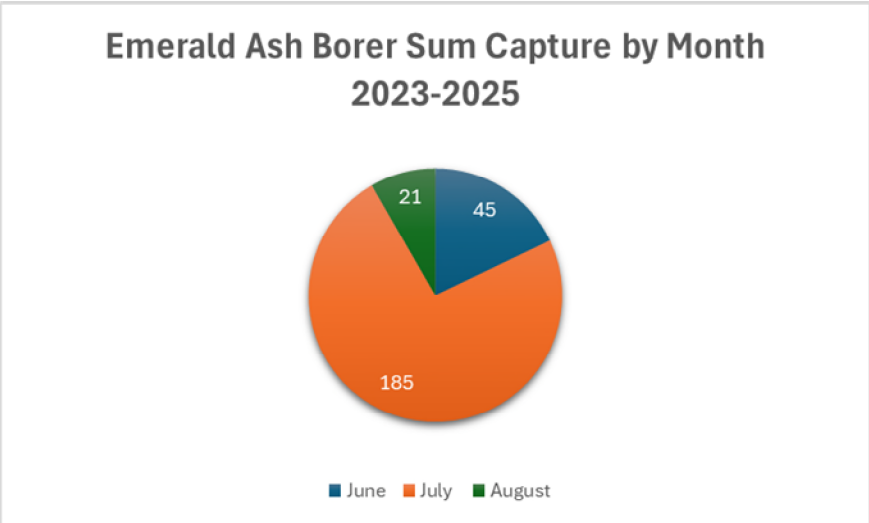
average capture amount with 17 beetles caught, and Williams Township Park had 5 beetles caught.

Overall, the higher the traps were, the better their catch results. A previous research paper also supports this claim with a height to beetle catch relationship (Crook et al., 2008).

From 2023 to 2025, this research project had a collective total of 250 Emerald Ash Borer caught.







Other bupresitds and various insects

There were many other species of *Agrilus* caught in the traps. Species outside of Emerald Ash Borer that were caught were identified to the best of staff's abilities using Buprestid field guides and other insect family resources. Due to the program's restrictions on laboratory equipment, identified species are estimated and should not be taken with full certainty.

In 2023, species identified include *cephalicus, masculinus, parvus, lacustris, anxius (bronze birch borer), sulcicollis (European oak borer), egeniformis, fallax, pseudofallax, juglandis, cuprescens, cyanescens, atricornis, putillus, paracelti, otiosus, and defectus*. One caught was *Agrilus subcinctus*, which is considered the true native ash borer in North America. Other species outside of the *Agrilus* jewel beetle family may include *Anthaxia inornata, Chrysobothris neopusilla, and Xiphydria mellipes* (wood wasp). Numerous species of Flatidae, Acanaloniidae, Cicadellidae, Diptera, Pholcidae and Pentatomidae were also caught, including many more. A few *Spathius agrili* were caught, which was the wasp parasitoid that was native to Asia and purposely released in the United States to help control populations of Emerald Ash Borer.

Bronze Birch Borer, Photo by Alfredo Colon

2024 insects: In 2024, species identified include *Agrilus cliftoni, Agrilus lacustris, Agrilus crinicornis, Agrilus cyanescens, Anthaxia inornata, Anthaxia viridifrons, Chrysobothris sexsignata*, and numerous *Agrilus egenus* beetles.

2025 insects: In 2025, species outside of Emerald Ash Borer collected include *Agrilus masculinus*, numerous *Agrilus anxius* (bronze birch borer), *Agrilus egenus, Agrilus criddlei, Anthaxia fisheri, Anthaxia quercata, and Anthaxia inornata*. Numerous other insects within the Diptera, Cicadellidae, Flatidae, Acanaloniidae, Pholcidae, and others were caught (Paiero et al., 2012).

Girdling

During the summer of 2023, three small but healthy ash trees were girdled in proximity to the traps at the Pinconning Park site. The purpose of this was to entice Emerald Ash Borer females to lay eggs on the recently stressed trees, and larvae would then begin feeding on the tissue of the tree (McCullough, et al., 2009b). These ash trees were intermingled with the other young ash at this site. Each of these trees were 4 inches DBH, to make it easier for felling and debarking the trees. In the early winter, each tree was taken down and cut into pieces to be taken into the Forest Sustainability office in the Bay County building. A vice was placed on the office drafting table to secure the logs. Each log was carefully and slowly debarked using a drawknife. Unfortunately, out of all the trees, no Emerald Ash Borer larvae were found. Because girdling was not effective in the first year of the research project, as well as the realization that Emerald Ash Borer could be readily captured with canopy traps and lures, girdling was not implemented for the following two seasons. Although no live larvae were found, two galleries were identified from recent years, and specifically one gallery that seemed to be fresh, indicating that a larva was feeding on the tree from the previous year at the time the tree was felled (what would have been 2022).

Discussion

Overall, a total of 250 Emerald Ash Borer beetles were caught over the three-year span that this research project took place. The purpose of this project was to prove to the landowners of Bay County that Emerald Ash Borer still existed post-invasion, even with much of the ash tree population gone. Catching 250 EAB proves these beetles continue to be an existential threat to the remaining ash and that the beetle's population numbers remain stable in this post-EAB invasion era. Through surveying in the field, there still remains high numbers of regenerative ash trees in the understory and lowlands of different habitats around Bay County, and Emerald Ash Borer will likely continue to thrive in these areas instead of dying out.

During the first trapping year of 2023, Frankenlust may have garnered a high capture rate due to prime areas for young, regenerative ash to grow, such as the Squaconning Creek that runs right by where the ash tree traps were, the Dutch Creek wetland area, and the Saginaw River system around the Crow Island area (Kennedy, 2026). The distinction is that these areas are ideal for young ash growth, but they are generally smaller areas along these waterways, and the majority of agricultural land fragments these areas. Because of this, the Emerald Ash Borer will have young regenerating ash near these waterways, ditches, and streams, but the agricultural land limits what would otherwise be a continuous woodland dominated by ash species. Therefore, one of the reasons the Frankenlust location may have performed the best is because the young regenerating ash are producing new Emerald Ash Borer populations, and once emerged these beetles were restricted with their feeding/reproducing areas. Because of this competitive landscape, the beetles were drawn to the volatiles coming from the traps in large, mature ash trees open to sunlight at the Frankenlust Township Hall compared to the other trap site locations that may have a much larger regenerating ash population.

Another topic to consider is how Frankenlust was by far the consistently windiest location of the sites. This may have helped the volatile's potency in the area by spreading that attraction for the Emerald Ash Borer to detect at long distances. The trap that did the best at Frankenlust, Trap B, was also one of the highest traps from the distance to the ground in the

canopy of the ash tree. The trap being high in the canopy, along with direct sunlight, as well as high winds to spread the volatile, may have created a trifecta of perfect factors for the attraction of Emerald Ash Borer. Ash canopies in direct sunlight have been proven to be an attraction for Emerald Ash Borer in previous studies (McCullough et al., 2009a).

The lowest site of beetle collection was the Bay County Golf Course, only catching a single Emerald Ash Borer beetle over the course of two summers. Two of the traps were in untreated ash here, and there were found to be sporadic spots of untreated ash along the ditches, drains, and public areas such as the Finn Road Park and the nature trail owned by the DNR close by. The vast majority of this land is unforested, with agriculture being the dominant land use as well as the suburban areas of Essexville. Because of the land makeup, the Emerald Ash Borer may simply have a much lower sustained population compared to the rest of the county, but the single catch still proves that there is a low population that lingers on. Also, the widespread amount of treated ash in the golf course far outweighs the numbers of nearby regenerative ash, and the treated ash would act as a hindrance to the beetle's population numbers, since any eggs laid would lead to larval mortality (Poland et al., 2016). This highlights the importance of implementing large-scale ash treatment in public settings.

During the 2024 season, Finn Road Park captured lower numbers similar to the Bay County Golf Course. The site conditions were not ideal for sunlight, which could have reduced the numbers that were caught at this site. Where the traps were hung, as well as many of the trees in the area, were healthy regenerative ash in the understory of the small woodlot.

There was a significant increase in EAB numbers caught from 2023 to 2024, as a single site, Fraser Township Hall, was able to collect more beetles than the entire amount caught for the 2023 season. This continued into the 2025 season. Similar to the Frankenlust site's 2023 results, Fraser's successful traps, A and B, were in large, mature ash trees that were experiencing dieback from beetle larval feeding and showed visible signs of stress. It was also in a windy and sunny location, being right next to a road as well as a large open agricultural field that creates a defined edge. This combination could have made this site more attractive for the beetles.

An unexpected outcome of the study was the difference in catch numbers between some of the forested areas and some of the more hybrid woodland/agriculture regions in the center to southern end of Bay County. Initially, expectations were that the wooded areas such as Bentley and Pinconning would have the highest trap totals each season due to a much larger percentage in forest canopy, which would indicate a higher likelihood of lingering or regenerative ash. Instead, results showed the opposite, with areas such as the Fraser Township Hall site and the Frankenlust Township Hall site experiencing higher Emerald Ash Borer capture totals each season compared to the more forested trapping sites. The highest catch trapping sites had a number of conditions that made them more ideal. Sunlight is shown to be a benefactor for increased catch rates, and the shaded canopy of forested areas are less ideal. Open or fragmented edges of ash, which also allowed for increased wind dispersal for the canopy traps, may have also been beneficial for EAB attraction by allowing the traps to be easily seen and the lure volatile to be easily identified (McCullough et al., 2009a).

Conclusion

This project initially sought to answer the question from local residents of where Emerald Ash Borer populations stood within Bay County, and this research was able to successfully answer that question by finding EAB populations at all sites where traps were placed. This project highlights the significant importance to continue treatment of publicly treated ash trees within the Bay County Forest Sustainability Program's treatment operations. Ash trees were once a foundational species in Michigan's forests (Leatherberry, 2002). Now, every native Michigan ash species is critically endangered due to the Emerald Ash Borer. The number of beetles caught in the traps is just a small sample of the portion of the population that is in Bay County. This data demonstrates that continued treatment of endangered ash trees is essential to prevent significant economic costs for residents and to reduce the burden on Bay County and other local municipalities associated with removing trees destroyed by Emerald Ash Borer infestations, as well as increasing public safety for trees and minimizing risk factors a stressed ash tree could potentially cause if one were left untreated. Many streets in Bay City and Essexville would be bare of canopies if ash tree treatments were to cease, causing not only economic harm but ecological harm and potentially mental stress to street residents (Zhang et al., 2020). Ash trees define the canopies of school yards, playgrounds, public parks, local golf courses such as the Bay County Golf Course, and many other publicly owned spaces that provide value to our community. Losing these trees would mean losing a piece of our history. The loss of these canopies would negatively affect the aesthetics of the areas they define and increase risk concerns from dying trees in poor health. Most importantly, the Forest Sustainability Program should keep these endangered trees around to try and protect some of the few remaining, healthy, mature ash trees that are in Michigan's lower peninsula.

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