



USDA APHIS PPQ *2017 Emerald Ash Borer Survey Guidelines*

Introduction

Survey for emerald ash borer (EAB) has undergone an evolution of tactics, scope, and application since its discovery in 2002. Survey was originally based on visually detectable symptoms (exit holes, bark cracks, epicormic branching, woodpecker feeding sites, etc.) to determine presence or absence of EAB. Visual survey was applied at various levels of intensity and with various techniques (*e.g.*, ground surveys, ladders, climbing devices, bucket trucks). Overall results were poor and newly infested areas were often left undiscovered. It soon became apparent that destructive sampling of suspect trees was necessary.

Artificially stressed (girdled) trap trees offered an alternative to visual survey and were adopted program-wide in 2005. This technique was an improvement for defining or delimiting the extent of an EAB infestation and was used to evaluate areas treated for EAB (eradication cuts). Trap trees, however, are expensive to establish and evaluate, and offer liability problems for workers and the public. Uniformity of survey is also an issue because of difference in size, species, and locations of trees as well as methodology and timing of stressing prior to adult flight.

Continued developments in trap and lure design enabled the EAB Program to implement a survey based on attractant-baited traps in 2008. Traps offer several advantages over trap trees including lower cost, uniformity of sampling unit, greater safety, fewer logistical problems, and more precision in sampling. Based on the positive results and feedback from the trap-based 2008 through 2016 surveys, APHIS's 2017 EAB National survey will continue to rely primarily on purple prism traps (approximately 18,000).

Since 2012, trap placement has been based on a survey sampling design developed in collaboration between the APHIS EAB Program and the U.S. Forest Service's Forest Health Technology Enterprise Team. The 2017 National EAB survey will use similar methodology. This computer-generated EAB survey sampling design product combines a scientific model of the likelihood of detecting EAB with historical program data and regulatory knowledge. Very simply stated, the survey sampling design model will pre-select geographic locations (cells) to deploy EAB traps resulting in the highest probability of pest detection. The expected benefit of the 2017 EAB survey is three-fold:

- To increase the number of successful EAB detections outside the known infested area
- To improve land managers capability of detecting EAB close to the date of a new attack
- To find locations that are best suited to implement biological controls

For additional information, see Appendix A on Page 14: Details of Survey Sampling Design Construction.

Survey Objective

In 2017, the EAB Program seeks to conduct a national survey to determine whether additional pockets of infestation may exist undetected surrounding the known infested areas, to better define the leading edge, and to identify areas for biological control and mitigation activities. This 18,000 trap survey will target sites at risk for the introduction and establishment of EAB through risk-

based modelling. In addition, the highly visible survey supports public outreach thereby increasing awareness and reporting of the pest.

Independent Surveying

In addition to the national survey, APHIS will support our partners and stakeholders who wish to survey for EAB in areas excluded from the survey sampling design. Support for this type of survey will be dependent upon resource availability.

All survey and public outreach activities should be coordinated with Tribes, Federal, State, and local agencies and organizations to ensure efficient use of resources.

Trap Placement Protocols

The risk-based sampling design generates a science-based, objective survey. The sampling design identifies cell locations for the placement of traps with each cell identified by latitude, longitude, county, and state.

Trap placement should be coordinated with State Plant Regulatory Officials and Tribal governments where Tribal lands are involved. Coordination also should occur with other Federal, State, and local agencies, and non-governmental organizations involved in the program. To ensure the highest probability of detecting EAB, traps should be set in trees that meet the criteria as described in the Trap and Sign Placement paragraph on page five of these guidelines.

The list of trap cell locations generated by the survey sampling design includes the latitude and longitude for the center point of each cell in which a trap is to be placed. Navigating to each cell will require the use of a global positioning system (GPS) unit. Set-up and guidance information for GPS units is provided in Appendix B on page 16.

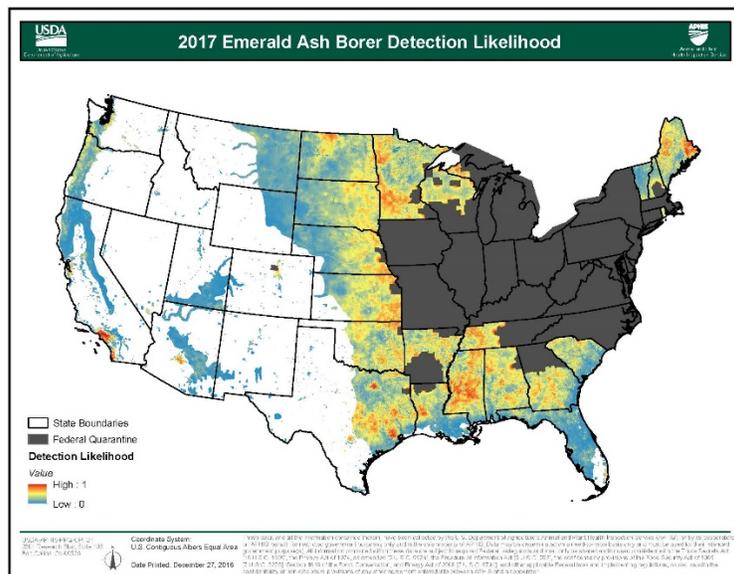


FIGURE 1. 2017 Emerald ash borer survey map (Please see page 19 for larger format map).

A limited number of threatened and endangered species of insects could be caught in the purple prism trap. These species include the delta green ground beetle, Hine’s emerald dragonfly, Mitchell’s satyr butterfly, Saint Francis’ satyr butterfly, the Laguna mountains skipper, and the valley elderberry longhorned beetle. Sampling locations within critical habitat areas for

potentially affected threatened and endangered insect species were discarded from the sampling design. Traps must not be set in critical habitat areas for these species. In addition, to avoid inadvertent capture of Karner blue butterflies, traps should not be set in jack pine and oak savannah with well drained sandy soils habitat in Massachusetts, New Hampshire, New York, and Wisconsin. Please consult EAB Program management for guidance if needed.

In cells where high-risk facilities or conditions are present and suitable ash trees are located, traps should be located in an ash tree as near as possible to the high risk facility. Prioritized high risk facilities include:

1. Campground, recreation area, cottage community, summer camp
2. Major transportation artery, rest area, truck stop
3. Sawmill, firewood dealer, nursery, tree care company
4. Recently landscaped residential and commercial property
5. Site of high attendance/ high profile cultural event: Pow-Wow ground, hunting lodge, NASCAR track, horse trail ride site, motor cross site, rafting and fishing camp

NOTE: Ash trees within the cell exhibiting two or more of the symptoms listed below should also be examined using destructive sampling techniques (*i.e.*, the removal of bark to inspect for EAB):

- Canopy stress/dieback
- Epicormic shoots/suckering
- Bark splits
- Woodpecker damage
- D-shaped exit holes (3-4 mm diameter)
- Serpentine larval galleries

Conducting Survey and Inspections:

- Identification of most suitable site and tree within the designated cell
- Distribution of educational material where appropriate
- Placement and maintenance of traps
- Visual survey of the environment for ash trees exhibiting signs and symptoms of EAB in proximity of the traps.

NOTE: For various reasons it may not be possible to place a trap in a cell as designated by the survey sampling design. Those cells must be recorded according to the following definitions:

Omitted: The cell is inaccessible – no trap can be set

Declined: The cell is viable but survey resources are limited – no trap can be set

Purple Prism Trap Assembly and Placement

Timing of Trap Placement: Research indicates that an accumulation of 450 growing degree days (base 50°F) results in initial emergence of EAB adults. Traps should be placed just prior to 450 growing degree days (GDD) and lure replacement is recommended to occur just prior to the 60 day expiration date. In order to assist States with timing of trap placement, a map of the conterminous U.S. depicting predictive bands of initial emergence are appended to this document (Please see page 20 for GDD map). Appendix C (see page 17) defines, by state, when initial emergence is predicted to occur.

Trap: A prism trap consisting of three 14" x 24" panels with several holes for trap and lure attachment (Fig. 2) will be used. The trap is constructed from a sheet of pre-glued purple corrugated plastic. An instructional video detailing trap assembly and use can be found under Pest Management [here](#). (Please note that when assembled the pre-glued face of the panels should be the exterior face.)

After the trap is assembled into its prism shape, spreaders are attached to the trap at holes labeled (3) in Fig. 2. The lure is attached to a loop on the spreader using a cable tie (Fig. 3).

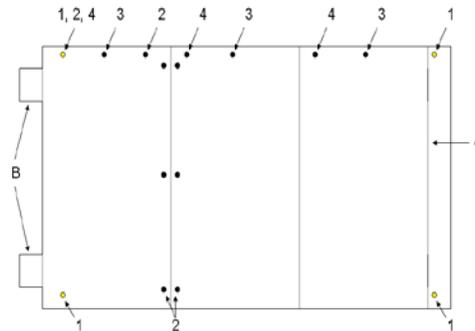


FIGURE 2: Prism trap diagram

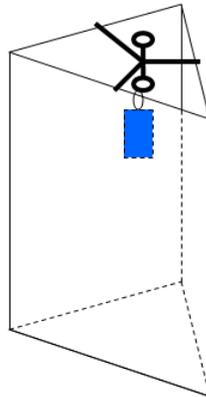


FIGURE 3: Lures hung from loop on spreader using a cable tie

Lure: One pouch of (Z)-3-hexanol is recommended to be attached to each trap. The lure provided by commercial firms is produced as a pouch and designed to last in the field for 60 days. Lure attachment to the trap should be reinforced with duct tape placed at the very top to ensure continued attachment during inclement weather. **Do not cover the lure with duct tape** as that will inhibit the release of the lure. If possible, any unused lure remaining at the end of the trapping season should be stored (refrigerated or frozen) for future use in EAB surveys. Research suggests that the Manuka oil lure provides a negligible increase in trap efficacy, therefore the Program has decided to discontinue its use in the national survey. However, any remaining Manuka oil lure from previous surveys within the past two to three years may also be used.

Lure Handling, Transport, and Storage:

The (Z)-3-hexanol lure pouches emit odors and volatiles which pose safety and health concerns in confined spaces. EAB Program Managers have worked closely with the APHIS Safety and Health Manager and the lure manufacturer to develop protocols for the safe handling, transport, and storage of our lures. In summary, prior to deployment, lures must be kept cold at all times by

storing in a freezer. During transport, lures must be kept in coolers with cold packs or ice and stored in isolation from the vehicle's cab, or, as an alternative, kept in coolers with screw top lids that also must be chilled with cold packs or ice. Cooler should be labeled "NOT FOR FOOD OR BEVERAGE USE". To avoid skin irritation during handling, gloves may be worn. Additional information and precautions can be found in a Job Hazard Assessment and Material Safety Data Sheets for the lure pouches and are available from the local APHIS PPQ Safety Coordinator.

Trap and Sign Placement: Traps must be placed in ash trees (*Fraxinus* spp.). If possible, ash trees should be 8" or greater in diameter with *larger or largest ash tree in a stand of trees* located along edges, in open areas, or in open stands such as in parks. Traps should be placed in the lower to mid canopy, but with the bottom edge of the trap no lower than five feet above the ground. They should be placed on the sunny side of the tree, most typically, the south or southwest side.

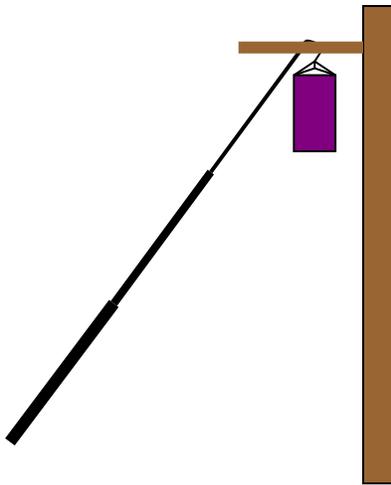


FIGURE 4: Purple prism trap hung using a telescoping pole

A wire hanger will be used to hang purple prism traps (Fig. 4). A telescoping pole that extends to 24' (different models are available at Home Depot, Lowes, Amazon, and other retailers), and fitted with a hook to place the purple trap in one of the lower limbs, is recommended. The full extension of the pole may be necessary. Alternately, if all limbs are too high to reach with a pole, a throw line may be tossed over a limb, and a rope with a trap attached may be hoisted up into the canopy (Fig. 5).

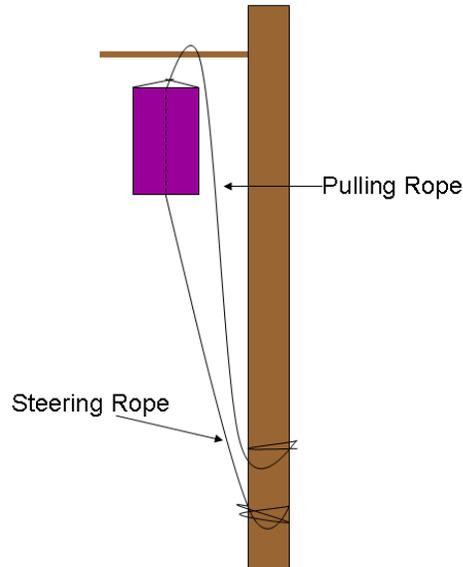


FIGURE 5: Purple prism trap hung using a rope

A 3"x5" survey sign (Fig. 6) will be provided and should be prominently displayed on the tree after the trap is set. States may also develop their own survey signs (please coordinate this activity with the APHIS EAB Program).



FIGURE 6: Survey sign

Trap Maintenance: A lure will last approximately 60 days and should be replaced just prior to expiration. Traps should be inspected for adult EAB at the time of lure replacement.

If trap surfaces are loaded with debris, they should be renewed by removing the debris and scraping the sticky compound. Scraping can be accomplished with a trowel or putty knife. If necessary, more sticky compound can be added using a paint roller or trowel. The sticky surface should remain intact throughout the season unless a trap is allowed to come in repeated contact with an adjacent branch or tree bole. Traps must not be removed prior to August 1 **and** before 1,500 GDDs have been exceeded.

Trap Disposition: While the polypropylene material of the traps is recyclable, the sticky compound that is adhered to the panels renders the traps undesirable to most recyclers. Alternatively, one may seek a user of waste fuel material for trap disposition. Hangers and spreaders are reusable and should be retained for future use. Hangers and spreaders that cannot be reused should be recycled.

Lindgren Green Multi-funnel Trap Assembly and Placement

Timing of Trap Placement: The timing for placement of Lindgren green multi-funnel traps is identical to the purple prism trap. Research indicates that an accumulation of 450 growing degree days (base 50°F) results in initial emergence of EAB adults. Traps should be placed just prior to 450 growing degree days (GDD) and lure replacement is recommended to occur just prior to the 60 day expiration date. In order to assist States with timing of trap placement, a map of the conterminous U.S. depicting predictive bands of initial emergence are appended to this document (Please see page 20 for GDD map). Appendix C (see page 17) defines, by state, when initial emergence is predicted to occur.

Trap: The trap is constructed from 12 green plastic funnels with a green dome-shaped top and a plastic collection cup at the bottom. Trap funnels and the dome are held together by black pegs. The collection cup is secured to the bottom with a twist-on motion. An eye screw at the top of the trap is used for rope attachment (see below). Multi-funnel traps are pre-assembled and pre-coated in a 1:1 solution of Fluon before shipment to field locations. The Fluon application provides a slippery surface that assists with the capture of EAB. Due to the modular nature of the traps, some minor assembly may be required.



FIGURE 7: Multi-funnel traps hanging in ash trees

Trap hanging: A rope should be thrown over a branch at approximately 16-26' above the ground. The limb hanger and pole should not be used for hanging the multi-funnel trap. The branch should be alive and sturdy (> 2" diameter), as smaller or dead branches could snap under the weight of the trap. An arborist throw weight (12, 14, or 16 oz.) can be tied to one end of the rope. Take care to clear the rope from all lower branches so that the trap can be pulled up and down like an elevator when servicing. The rope should have a clear path to the ground. The trap may need to be raised and lowered at an angle from the tree to accomplish this. Give yourself enough slack so that you can tie the rope to an adjacent tree.

A knot, similar to the one shown here is the preferred method:

(<http://www.fieldandstream.com/photos/gallery/fishing/bass/where-fish/2009/02/strongest-fishing-knots>)

Using these knots, tie the rope to two points on each trap. For the multi-funnel trap these points are the top metal hanger and one of the three holes on the bottom funnel used for peg attachment. The knot is important as high winds will sometimes cause the traps to come down if the knots are not tied properly.

When hanging the traps try to rest the top of the trap against the bottom of the tree limb. This should prevent the rope from twisting on itself. When attaching the collection cup, take care to make sure that it is securely attached to the bottom funnel.

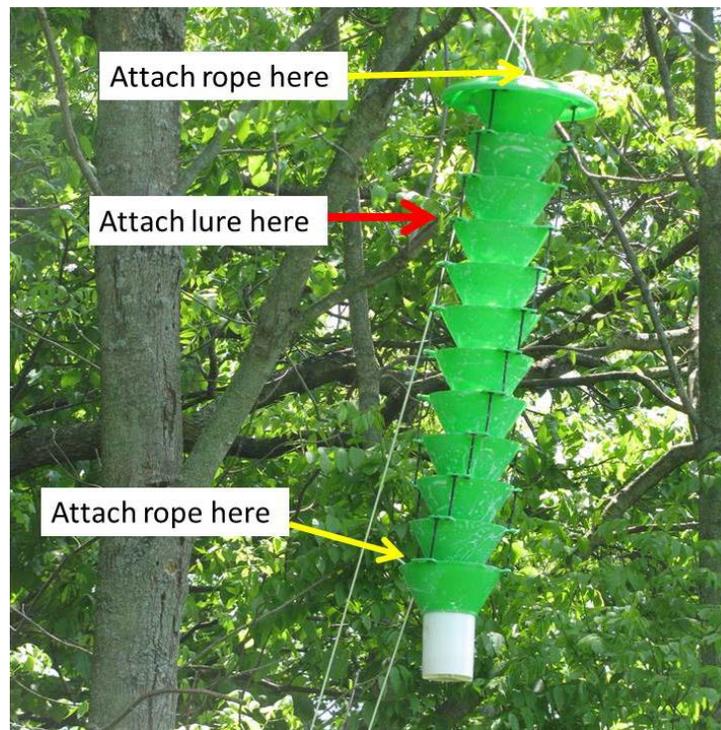


FIGURE 8. Green multi-funnel trap with attachment points for ropes and lures.

Prior to raising the trap, in the tree, fill the cup with approximately 2 inches of propylene glycol (RV antifreeze; usually pink in color). Do NOT use any product containing ethanol as products containing this will evaporate over time, especially in hot, dry climates or under drought conditions. Propylene glycol should not be diluted with water prior to filling the cup as it will be diluted by rainwater over time.

Once the trap is hoisted, tie it off to a tree (the one it is hanging from will work for this). Take care when tying this rope off to place it out of the reach of children or others who may want to pull it down.

Trap checking: When checking the multi-funnel trap, the contents of the trap should be poured through a paper filter. A paper cone paint strainer is the preferred method, although a coffee filter may also work but will retain more moisture. The strainer should then be placed inside a leak proof plastic bag. While wire closed bags (e.g., Whirlpaks) are the preferred method, a plastic zipper (e.g., Ziploc) bag will also work. Please make sure to label and seal the bag completely to prevent leaks. A small amount (one teaspoon) of ethanol may be added to the bag to help preserve the specimens for sorting in the lab. As long as the liquid in the cup is still pink, and

does not smell too badly, it can be re-used instead of discarded during traps checks. Place a propylene glycol collection container under the filter when pouring out the sample.



FIGURE 9. Paper cone paint strainer containing a sample of beetles

A (Z)-3-hexanol lure pouch should be hung from the lower loop of the prism trap spreader or from one of the holes used for peg attachment near the top of the multi-funnel trap with a small plastic cable tie. The lure should be changed after 60 days.

Trap and Lure Handling, Transport, and Storage:

EAB Program Managers have worked closely with the APHIS PPQ Safety and Health Manager and the trap and lure manufacturers to develop protocols for the safe handling, transport, and storage of our traps and lures. The green multi-funnel trap is coated with a fluoropolymer resin commonly referred to as “fluoⁿ”. EAB program uses manufacturer pre-treated “fluoⁿ” traps only for program use. This slippery resin may be an irritant to some which can be negated through the use of nitrile gloves during handling. Eye protection (vented splash goggles and face shield) should be worn while raising the trap into position in order to avoid any propylene glycol spillage contacting the eyes. The (Z)-3-hexanol lure pouches emit odors and volatiles which pose safety and health concerns in confined spaces. Prior to deployment, lures must be kept cold at all times by storing in a freezer. During transport, lures must be kept in coolers with cold packs or ice and stored in isolation from the vehicle’s cab, or, as an alternative, kept in coolers with screw top lids that also must be chilled with cold packs or ice. Cooler should be labeled “NOT FOR FOOD OR BEVERAGE USE”. To avoid skin irritation during handling, gloves may be worn. During handling of lure, open down-wind in an open well-ventilated environment. Additional information and precautions can be found in a Job Hazard Assessment and Safety Data Sheets for “fluoⁿ”, propylene glycol, and the (Z)-3-hexanol lure pouches in each sites specific Safety Data Sheet manual. Contact your local APHIS PPQ Safety Coordinator or supervisor for more details.

Trap and Sign Placement: Traps must be placed in ash trees (*Fraxinus* spp.). If possible, ash trees should be 8” or greater in diameter with *larger or largest ash tree in a stand of trees* located along edges, in open areas, or in open stands such as in parks within the grid cell. Traps should be placed in the lower to mid canopy, but with the bottom edge of the trap no lower than five feet above the ground. They should be placed on the sunny side of the tree, most typically, the south or southwest side.



FIGURE 10. Survey sign.

Trap Maintenance: The lure will last approximately 60 days and should be replaced just prior to expiration. **Multi-funnel traps should be checked every two-three weeks** (and any insects that are captured should be collected). When reattaching cups, please make sure that all pegs are securely locked in place as they may come loose under some weather conditions.

Trap Disposition: Multi-funnel traps are designed to be used over several field seasons. At the end of the season, the collection cups may be gently scrubbed, and dirt may be wiped away from funnels with a cloth (take care not to remove too much of the slippery Fluon coating). Traps will collapse into a smaller form for storage and subsequent reuse.

Screening for Suspect Buprestidae and Specimen Submission

Any suspect Buprestidae adult or suspect adult EAB specimen collected from a trap in a **non-quarantined** county should be placed in a dry vial. If the specimen is from a purple prism trap, use the sticky compound from the trap to stick the specimen to the side of the vial and/or gently pad with soft tissue placed into the vial on top of the specimen(s) to prevent damage during shipping. Sorted specimens collected from Lindgren traps should be placed in a vial and gently padded with soft tissue placed into the vial on top of the specimen(s) to prevent damage during shipping. Larval samples need to be shipped in a vial containing 70% ethanol. (If guidance is needed on proper packaging to ship larvae in ethanol, please contact your local PPQ Safety Coordinator.) All suspect specimens should be delivered to the State Plant Health Director or APHIS representative to be packaged and shipped to Dr. James Zablotny along with a completed “Specimens for Determination” PPQ form 391. Be sure to include any survey record number and GPS coordinates on the PPQ form 391 so identified specimens can be linked to survey records.

Dr. James Zablotny
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11200 Metro Airport Center Drive, Suite 140
Romulus, MI 48174

Phone: 734-942-9005
E-mail: james.e.zablotny@aphis.usda.gov

Dr. Zablotny will make a determination and send specimens to the Systematic Entomology Laboratory (SEL), if necessary, for initial State detection confirmation.

Any suspect Buprestidae adult or suspect EAB specimen collected from a trap in a **quarantined** county should be placed in a dry vial. Using the sticky compound from the trap, stick the specimen to the side of the vial and/or gently pad with soft tissue placed into the vial on top of the specimen(s) to prevent damage during shipping. Larval samples need to be shipped in a vial containing 70% ethanol. (If guidance is needed on proper packaging to ship larvae in ethanol, please contact your local PPQ Safety Coordinator.) All suspect specimens should be delivered to the State Plant Health Director or APHIS representative to be packaged and shipped to Mr. Bobby Brown along with a completed “Specimens for Determination” PPQ form 391. Be sure to include any survey record number and GPS coordinates on the PPQ form 391 so identified specimens can be linked to survey records.

Mr. Bobby Brown
USDA, APHIS, PPQ
901 W. State Street
Smith Hall, Purdue University
West Lafayette, IN 47907-2089

Phone: 765-496-9673
E-mail: robert.c.brown@aphis.usda.gov

Data Management Structure For: Emerald Ash Borer (EAB) – Agrilus planipennis

PPQ wants to make it clear that the National “Integrated Plant Health Information System” (IPHIS) is not required as a field data collection tool. We do believe however that operationally specific data is of great importance and therefore have designated the IPHIS application to be utilized as the final holding tank (centralized database) for EAB data.

IPHIS requires Internet access, USDA eAuthentication credentials and approved access to an IPHIS PPQ or cooperator office. If you need an eAuth username and password, USDA employees should apply for a [Level 2 Account](#) and cooperators a [Level 1 Account](#) at:

<https://www.eauth.usda.gov/mainPages/eAuthSiteMap.aspx>.

After receiving network access, eAuth credentials and IPHIS access, users can log into the system and utilize two types of data entry methods. These include the IPHIS web interface and Excel spreadsheet upload files. An AllInOne Excel spreadsheet upload file, for *initial trap installations* and *omits*, is available [here](#).

Please use the IPHIS template “[EAB 2017 Natl Survey](#)” for EAB trapping and omit data.

Note: IPHIS can now receive unlimited uploaded records in a spreadsheet.

The data fields created for the 2012, 2013, 2014, 2015, and 2016 EAB surveys are also used in the 2017 EAB survey. We do not ask surveyors to collect symptom data, and the fields for DBH and Trap Height are optional. Additional optional fields include: (1) site type categories and additional free text, (2) a field for assigned cells with no trap placement, including omitted and declined cells, and (3) fields to record omit reasons for assigned grids and comments.

Please record the state’s assigned Grid_Number as IPHIS’ Location Name; the IPHIS Site Name can also be assigned this value. Traps placed outside assigned Grid_Number cells should use the following naming convention for Location Name:

2 letters for state designation + 3 letters for surveyor’s initials + 3 digit sequential trap number (e.g., IAJAD003 for Iowa, John A. Doe, Trap 3).

The state’s sequential trap number begins with 001 for the first trap not having a assigned Grid_Number and increases by one for each additional trap (second trap is 002, the third is 003 and so on).

For consistency with other state trapping programs, we encourage users to use existing procedures and tools for recording data in the field. A field data form for the manual recording of data is in Appendix D. Organizations using paper, spreadsheets, or third party software can enter data directly into the web interface or “bulk” upload data from the Excel spreadsheet using the web upload tool.

It is very important for survey personnel to upload data every other week throughout the season!

Technical Support

1 (877) 944-8457 (select option 3)
6:30 am to 8:00 pm ET, Monday - Friday

Communication: 2017 EAB Survey

The risk-based survey sampling design continues to determine trap dispersal. A variety of materials will be developed to facilitate communication and understanding among key audiences who include Federal, State, and Tribal partners, survey cooperators and contractors, the media, and the public at large. Materials will include but are not limited to key messages, talking points, and Frequently Asked Questions (FAQ's).

The highly visible purple prism traps and Lingren green multi-funnel traps generate curiosity which often results in public questions and media inquiries. Individuals involved in the actual placement and maintenance of traps should be conversant with survey messages and understand media protocols. Furthermore, the EAB survey provides a springboard for other program messages addressing control, regulation, and the human-assisted spread of the pest. Communication staff and program personnel should also be broadly familiar with the core program messages about these issues.

EAB Program Outreach & Education:

The active participation of target audiences to assist in preventing the spread of emerald ash borer throughout the United States is critical. Outreach—an integral element of the EAB Program supporting regulatory, survey, and control—is a basic task for all program staff and a value-added opportunity for each personal encounter, engagement, or exchange. Formal strategic communication and outreach campaigns targeting industries that move regulated material should be implemented together with public awareness campaigns designed to provide education to citizens about the dangers of moving infested host materials such as firewood. Since the beetle is difficult to detect, the more people trained to identify EAB symptoms or damage and report suspects, the greater the opportunity for successful outcomes. Outreach activities encourage the public to recognize and report possible beetle damage in their area as well as suspected incidents of quarantine violations.

Appendix A. Details of Survey Sampling Design Construction.

The 2017 EAB survey employs a computer-generated risk assessment product to guide the deployment of detection tools in a way which results in the following benefits:

- increase the number of instances of successful EAB detections outside the known infested area
- improve land managers capability of detecting EAB close to the date of a new attack
- find locations that are best suited to implement biological control

The 2017 EAB Risk Assessment product was developed using an ensemble (or combination) of statistical models for predicting where EAB was most likely to be detected. This is a major change in modeling procedure over previous years which employed the MaxEnt statistical model, which used only positive detections for EAB. Given the last few years of nationally consistent data collection which reports both positive and negative detections, we upgraded the models to utilize that information in order to avoid some major statistical assumptions regarding the data. In doing so, we discovered that all the models concurred in predicting risk in the known infested area but differed widely in extrapolating that risk to outside the infested area. This is consistent with our knowledge concerning the difficulty of pest detection, so an “ensemble” of the models was created to mitigate model uncertainty between statistical platforms. There were two model applications for each statistical platform: One using all 2011-2016 trap data (modeling full geographic potential) and one model using 2015 trap data only (active spread).

EAB is an actively spreading pest and a false negative could be reported for two reasons: 1) the location is suitable but not yet infested, or 2) the pest is present but undetected. Utilizing negative trap location could be too restrictive in the model fitting process because of the potential for false negatives. While MaxEnt demonstrates flexibility regarding the “potential” of locations of having a pest present, we found that MaxEnt’s default assumption of pest prevalence (EAB can occupy up to 50% of the landscape) caused great overestimation of risk compared to models that utilized actual absence information. Since the EAB risk model is updated each year, we are mitigating the issue by allowing the model to update with new information as the pest invades new environmental gradients.

Four parameters were required to run the models. These were:

- 1) the dependent detection data from the APHIS IPHIS dataset (2011-2016), which consists of both negative and positive trap data
- 2) selected independent variables that correlate with the presence of EAB
- 3) a defined geographic area of interest.
- 4) limited to a maximum of 18,000 traps.

The independent variables were selected in the previous year using the following sources:

1. a review of scientific literature
2. expert opinion
3. anecdotal evidence
4. correlation analyses
5. preliminary statistical analyses.

Dissemination of trap resources is thus determined by this EAB Risk Assessment, combined with a spatially balanced sample design. The EAB Risk Assessment model has a known inclusion probability for every grid cell and provides an objective and transparent methodology for selecting trap locations. Since we are utilizing an ensemble model which is actually a percentage of model agreement of pest presence (rather than risk of pest presence like in previous years), the sample

design will utilize this ranking of model agreement as the inclusion probability surface. The 2017 EAB sampling design increases spatial independence among sample locations and therefore, maximizes sampling efficiency and provides the most information available per sample unit.

Each trap location is recommended for placement within a one kilometer square grid cell designated within a Conterminous United States (CONUS) grid cell, each with a unique ID, and also by the center point of the grid cell (identified by latitude and longitude).

Appendix B. GPS Guidance and Sample Location Information

Initial Requested Information

1. Field Crew Name
 - a. Crew ID (State and Affiliation (i.e., PPQ, State Dept. of Ag., Contractor, Volunteer) should be associated to the Crew ID)

Initial GPS Unit Setup Guidance

1. Depending on your GPS unit and what options that are available to you, please use the following guidance for collecting position information.
 - a. WGS 84 geodetic datum
 - b. Latitude/Longitude collected in Decimal Degrees format
 - c. Satellite Almanac (where applicable): Download the most recent Satellite Almanac to your unit.
 - d. Wide Area Augmentation System (WAAS) to improve the accuracy of the positions

Helpful Tips for Collecting Information at the Site

1. Turn the GPS unit on and allow the GPS unit to start gathering data when you arrive at the tree in which the trap will be hung. It may be helpful to turn the GPS unit on when you leave your vehicle.
2. Place the unit in a stable location while hanging the trap.
3. Collect location data at the tree in which the trap is hung
4. Ensure that you are collecting a signal from at least four satellites.
5. Location Data Collection
 - a. Location Name for Grid Cell = Cell_ID
 - i. When recording the Cell_ID (Location Name) in IPHIS, the Samp_ST_ID code assigned to each cell designated as a trap placement site by the survey design should be used if available. For cells which do not have a Samp_ST_ID code assigned, please use the following naming convention: 2 letters for State designation, 3 letters for surveyor's initials, and 3 numbers for trap number, e.g., IAJAD003, (Iowa, John A. Doe, Trap 3). Each surveyor should begin with 001 for the first trap which does not have an assigned Cell_ID and increased by one for each subsequent trap (the second such trap is 002; the third is 003 and so on).
 - b. Please see Appendix D for EAB Field Data form.
 - c. Latitude/Longitude
 - d. Omitted - with drop down list of potential reasons for the omitted cell (e.g. steep slope, inundated with water, dangerous terrain, dangerous neighborhood, etc.)
 - e. Notes for the surveyor's assessment of the site conditions (e.g. firewood, riparian, wooded lot, campground, lumber/saw mill, suburban, urban, new development, tree service company, etc.
6. **NOTE: It is very important for survey personnel to upload data every other week throughout the season!**

Appendix C. Predicted Growing Degree Day Zones for Initial EAB Emergence

| | | | |
|---------------|-----------|----------------|-----------|
| Alabama | 2/1/2017 | Montana | 6/1/2017 |
| Alaska | 6/22/2017 | Nebraska | 5/1/2017 |
| Arizona | 2/1/2017 | Nevada | 2/22/2017 |
| Arkansas | 3/15/2017 | New Hampshire | 6/1/2017 |
| California | 2/15/2017 | New Jersey | 5/8/2017 |
| Colorado | 4/22/2017 | New Mexico | 3/15/2017 |
| Connecticut | 5/22/2017 | New York | 5/15/2017 |
| Delaware | 4/22/2017 | North Carolina | 3/22/2017 |
| Florida | 1/22/2017 | North Dakota | 6/1/2017 |
| Georgia | 2/15/2017 | Ohio | 5/1/2017 |
| Hawaii | 1/22/2017 | Oklahoma | 3/5/2017 |
| Idaho | 5/22/2017 | Oregon | 5/22/2017 |
| Illinois | 4/22/2017 | Pennsylvania | 5/1/2017 |
| Indiana | 4/22/2017 | Rhode Island | 6/1/2017 |
| Iowa | 5/1/2017 | South Carolina | 3/8/2017 |
| Kansas | 4/8/2017 | South Dakota | 5/15/2017 |
| Kentucky | 4/8/2017 | Tennessee | 4/1/2017 |
| Louisiana | 2/15/2017 | Texas | 1/22/2017 |
| Maine | 6/1/2017 | Utah | 5/11/2017 |
| Maryland | 4/22/2017 | Vermont | 6/1/2017 |
| Massachusetts | 5/22/2017 | Virginia | 4/8/2017 |
| Michigan | 5/22/2017 | Washington | 5/22/2017 |
| Minnesota | 5/22/2017 | West Virginia | 5/1/2017 |
| Mississippi | 2/22/2017 | Wisconsin | 5/15/2017 |
| Missouri | 4/1/2017 | Wyoming | 5/22/2017 |

Appendix D

EAB Trap Sheet – 2017 Survey

1. **Date Set:** _____ **Date Serviced:** _____ **Date Picked up:** _____ **Trap Fallen/Replaced Date:** _____
Sampled (Y/N): _____ **Sampled (Y/N):** _____ **Trap Fallen/Replaced Date:** _____
No. Specimens: _____ **No. Specimens:** _____

2. **Location – Site:** _____
Use the 1 km grid number, and when outside the grid use “2 letter state name + 3 digit trapper initials + 3 digit sequential trap number” (ex. MIJHB001)

3. **Contact Name (if known):** _____ **Phone (if known):** _____

4. **Property Type Information (Campground, Park, Sawmill, Nursery, etc.):** _____

5. **Address / City / Zip (if known):** _____

6. **County:** _____

7. **Latitude/Longitude:** _____
(ex. 43.123456 / -91.123456)

8. **Trap Type:** Purple Prism Green Multi-Funnel

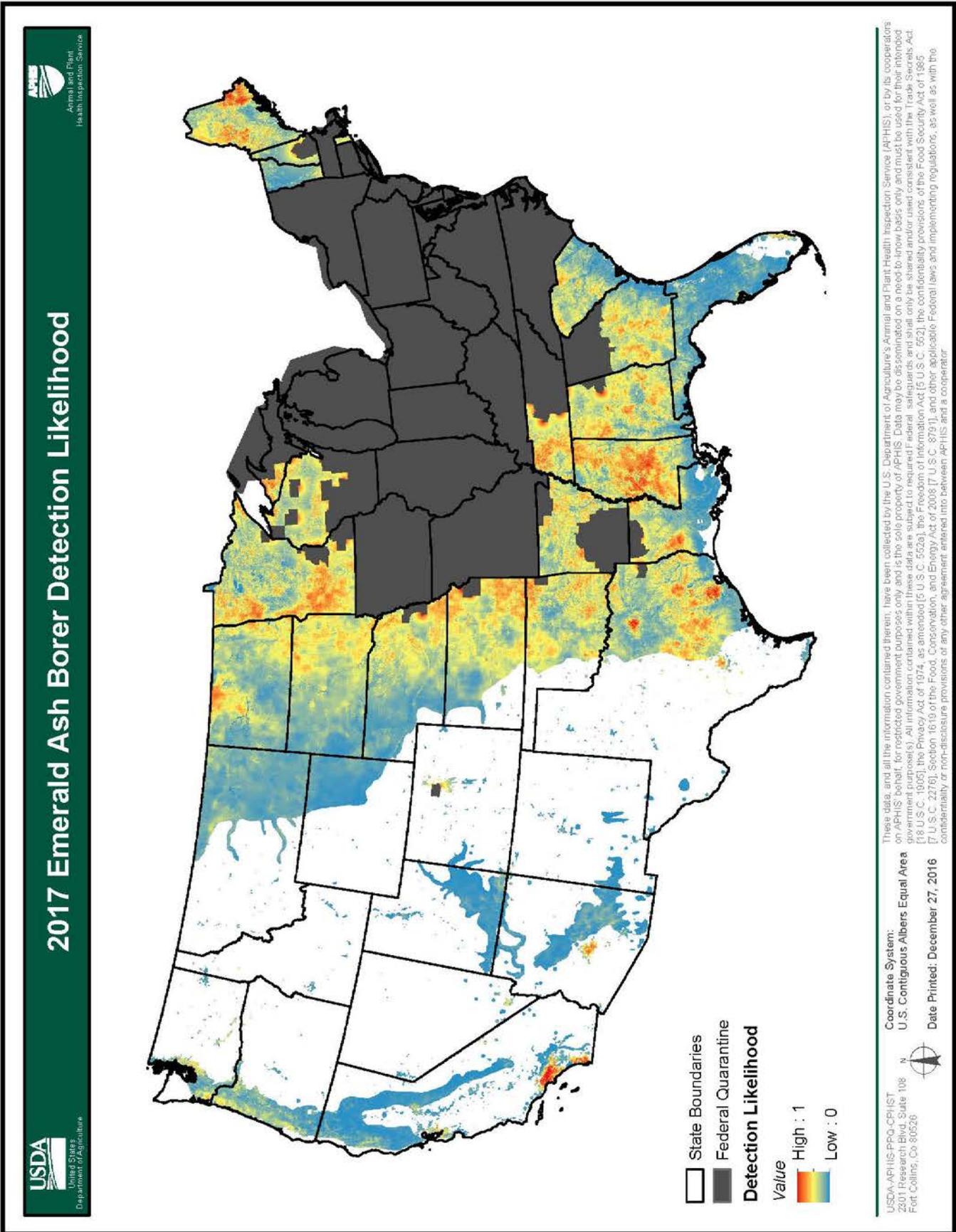
9. **Trap Height:** Low High

10. **Diameter Breast Height (DBH) Category:**
 1 - 5 6 - 10 11 - 15 16 – 20 21+

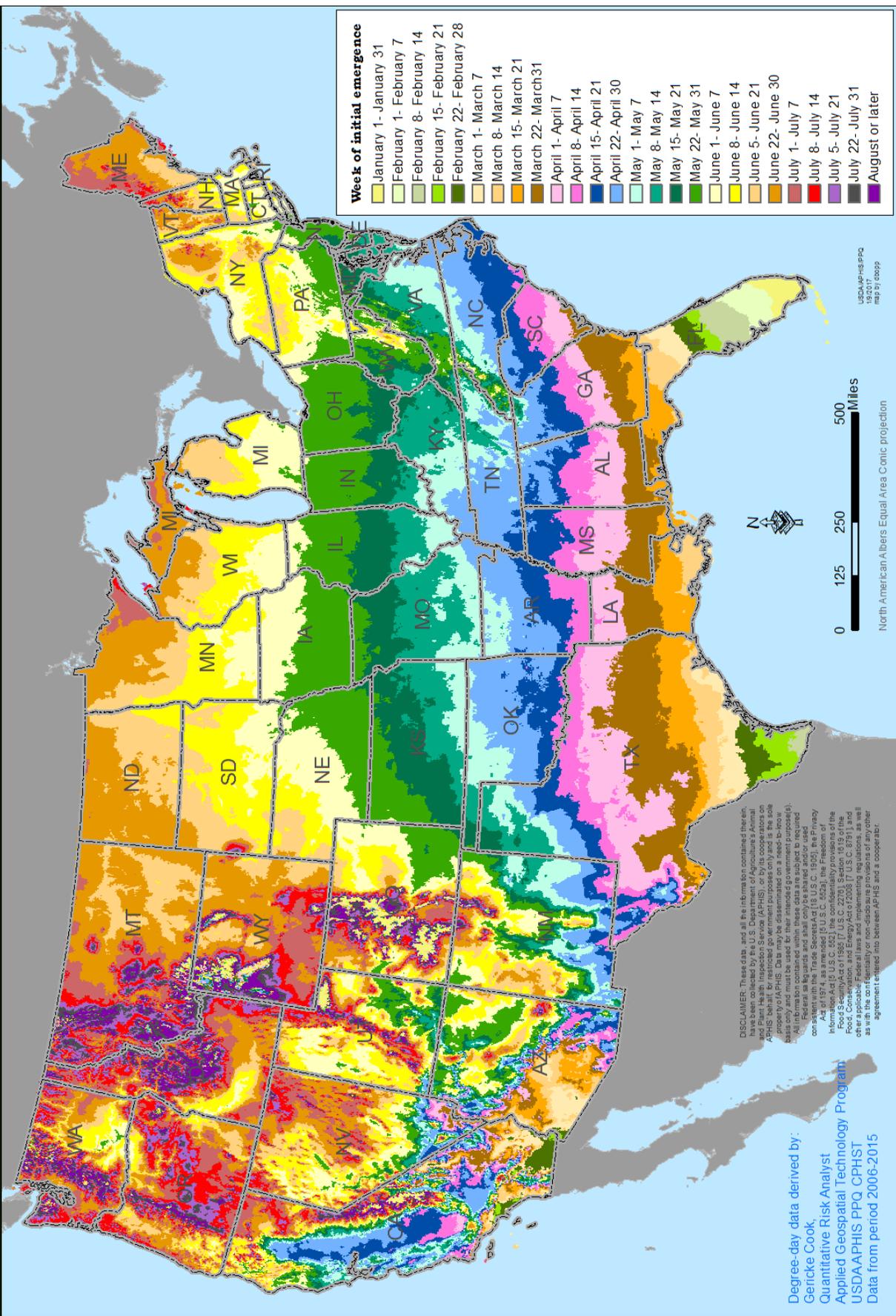
11. **Site Type:**
 Campground/Park Firewood Producers/Retailers
 Landscape Company Residence
 Rest Area Solid Wood Packaging/Pallet Site
 Special Interest Sites Tree Service
 Wooded Area Other: _____

12. **Omit Reason:**
 No ash present in cell No access, swamp
 No access, steep slope No road access
 No access, other difficult terrain
 Dangerous neighborhood Landowner refusal
 Other: _____

Written or Sketched Location Details (Optional)



Cooperative Emerald Ash Borer Project
 Probable EAB week of initial emergence within continental U.S.
 450 degree days



Degree-day data derived by:
 Genricke Cook,
 Quantitative Risk Analyst
 Applied Geospatial Technology Program
 USDA/APHIS, PPQ, CPHST
 Data from period 2006-2015