

United States
Department of
Agriculture

Marketing and
Regulatory
Programs

Animal and
Plant Health
Inspection Service

Cooperating State
Departments of
Agriculture

New Pest Response Guidelines

Emerald Ash Borer
Agrilus planipennis (Fairmaire)

DRAFT



New Pest Response Guidelines, Emerald Ash Borer, *Agrilus planipennis* (Fairmaire), ver. 1.1

Prepared by:

James H. Buck, Ph.D.
USDA, APHIS, PPQ Program Analyst
Emerald Ash Borer Emergency Program

Susan Frappier
USDA, APHIS, PPQ Supervisory Officer
Emerald Ash Borer Emergency Program

ACKNOWLEDGEMENTS

Considerable assistance, guidance, and review of sections in these New Pest Response Guidelines was contributed by: Philip Bell, Joel Floyd, Craig Kellogg, Sharon Lucik, Deborah McPartlan, Elizabeth Pentico, and Michael Stefan. Camille Chapman also assisted with formatting.

Cite this report as follows: USDA–APHIS. 2008. *New Pest Response Guidelines for the Emerald Ash Borer, Agrilus planipennis* (Fairmaire) USDA–APHIS–PPQ–Emergency and Domestic Programs–Emergency Planning, Riverdale, Maryland.

Rebecca A. Bech, PPQ Deputy Administrator

Walker G. Haun, National Plant Board President

USDA–APHIS–PPQ Emergency and Domestic Programs Emergency Planning, Michael B. Stefan,
Team Leader, 4700 River Road, Unit 137 Riverdale, Maryland 20737, Telephone: 301/734-4387
Michael.B.Stefan@aphis.usda.gov

Cover Illustration: Joel Floyd

CONTENTS

SECTION	PAGE
ACKNOWLEDGEMENTS	ii
CONTENTS	iii
LIST OF TABLES AND FIGURES	vi
1) INTRODUCTION	
a) Purpose	1.1
b) Disclaimers	1.1
c) Program Safety	1.1
d) Support for Program Decision-Making	1.1
2) PEST INFORMATION	
a) Systematic Placement	2.1
b) Background Information	2.1
c) Historical Information	2.1
d) Economic Impact	2.3
e) Host Range	2.4
f) Geographic Distribution	2.4
g) Biology	2.4
h) Life Cycle	2.5
i) Development	2.6
3) IDENTIFICATION	
a) Importance	3.1
b) Authorities	3.1
c) Identification	3.1
d) Similar Species	3.4
e) Collection and Preparation of Specimens	3.8
f) Screening for Suspect Buprestidae and Specimen Submission	3.8
4) SURVEY PROCEDURES	
a) Introduction	4.1
b) Trace Back and Trace Forward Investigations	4.1
c) General Detection Surveys	4.1
d) Initiating a Detection Survey	4.2
e) Survey Site Selection	4.3
f) Visual Survey	4.3
g) Symptoms of EAB Infestations	4.4
h) Setting Panel Traps	4.6
i) Creating a Detection Tree	4.9
j) Destructive Sampling	4.12

k) Preferred Order of Techniques for Destructive Sampling	4.14
l) Delimiting Survey	4.15
m) Monitoring Survey	4.15
n) Survey Sample Collection	4.15
o) Quality Control for Survey Activities	4.16
p) Survey Records	4.16
5) REGULATORY PROCEDURES	
a) Instructions to Officers	5.1
b) Authorities	5.1
c) Regulating the Spread of EAB	5.1
d) Regulated Articles	5.2
e) Approved Regulatory Treatments	5.2
f) Quarantine Boundaries	5.3
g) Regulatory Management of Outlying Infestations	5.3
h) Regulated Establishments	5.4
i) Principal Regulatory Activities	5.4
j) Investigations and Violations	5.5
k) Regulatory Records	5.5
l) Quality Control	5.6
m) Outreach	5.6
n) Special Regulatory Operations	5.6
o) Issuing an Emergency Action Notification	5.7
p) Removing Areas from Quarantine	5.7
q) Regulatory Forms	5.7
6) MANAGEMENT PROCEDURES	
a) Overview	6.1
b) Preventive Measures	6.1
c) Management Strategy	6.1
d) Community Preparedness Planning	6.2
e) Biological Control	6.2
f) Chemical Control	6.3
g) Management Records	6.3
h) Monitoring	6.4
7) ENVIRONMENTAL CONSIDERATIONS	
a) Overview	7.1
b) Disclaimer	7.1
c) Protected Species	7.1
d) Environmental Assessment	7.1
8) PUBLIC OUTREACH	
a) Introduction	8.1
b) General Outreach Objectives	8.1
c) General Outreach Activities and Initiatives	8.2
d) Outreach Material	8.3

e) Telephone Hotline	8.3
f) Web Site	8.3
g) Public Meetings or Informational Open Houses	8.3
h) Media Relations	8.4
9) REFERENCES	9.1
10) DEFINITIONS	10.1
10.1) APPENDICES	
Appendix A - <i>Agrilus planipennis</i> (Fairmaire) Screening Aid	A-1
Appendix B -Federal Compliance Agreement Template Reference	B-1
Appendix C – Emerald Ash Borer Program Contacts	C-1
Appendix D – Information Packet	D-1
Appendix E – Regulatory Operations Forms	E-1
Appendix F – Sources to Find Regulatory Concerns	F-1
Appendix G – PPQ Form 518 (Report of Violation)	G-1
Appendix H – PPQ Form 523 (Emergency Action Notification)	H-1
Appendix I – PPQ Form 530 (Limited Permit)	I-1
Appendix J – PPQ Form 540 (Certificate)	J-1

TABLES AND FIGURES		PAGE
Figure	2.1 Emerald ash borer life cycle	2.5
Figure	3.1 <i>Agrilus planipennis</i> egg on bark	3.1
Figure	3.2 <i>A. planipennis</i> egg cluster	3.1
Figure	3.3 Unhatched <i>Agrilus planipennis</i> neonate on bark	3.2
Figure	3.4 Three instars of <i>A. planipennis</i> larvae	3.2
Figure	3.5 Anterior abdominal segments	3.2
Figure	3.6 Posterior abdominal segments	3.3
Figure	3.7 <i>Agrilus planipennis</i> prepupal stage	3.3
Figure	3.8 Pupal ventral and dorsal views	3.3
Figure	3.9 <i>Agrilus planipennis</i> adult	3.4
Figure	3.10 <i>Agrilus cyanescens</i> and <i>A. bilineatus</i> adults	3.5
Figure	3.11 <i>Agrilus bilineatus</i> and <i>A. anxius</i> adults	3.6
Figure	3.12 <i>Agrilus masculinus</i> and <i>A. vittaticollis</i> adults	3.7
Figure	4.1 Symptoms of EAB on <i>Fraxinus spp.</i>	4.4
Figure	4.2 Symptoms of EAB on <i>Fraxinus spp.</i>	4.5
Figure	4.3 Trap hung using a telescoping pole	4.6
Figure	4.4 Prism trap diagram	4.7
Figure	4.5 Trap hung from tree trunk hanger strapped to a host tree	4.7
Figure	4.6 Method for creating a detection tree	4.11
Table	5.1 Interstate movement of regulated articles from quarantined areas	5.2
Appendices		
Figure	Figure 1 <i>Agrilus planipennis</i> Fairmaire	A-1
Figure	Figure 2 Pygidium of <i>A. planipennis</i>	A-1
Figure	Figure 3 Aedeagus of <i>A. planipennis</i> (a. tergal, b. sternal views)	A-1
Figure	Figure 4 <i>Agrilus bilineatus</i> (Weber)	A-2
Figure	Figure 5 <i>Agrilus cyanescens</i> Ratzeburg	A-2
Figure	Figure 6 <i>Agrilus anxius</i> (Weber)	A-2
Figure	Figure 7 <i>Agrilus vittaticollis</i> (Randall)	A-2
Figure	Figure 8 <i>Agrilus obsoletoguttatus</i> Gory	A-3
Figure	Figure 9 <i>Agrilus masculinus</i> Horn	A-3
Figure	Figure 10 <i>Agrilus subcinctus</i> Gory	A-3

1. INTRODUCTION

Purpose

These New Pest Response Guidelines contain information to guide a management program for the emerald ash borer (EAB) beetle, *Agrilus planipennis* (Fairmaire), (Coleoptera:Buprestidae).

The guidelines are intended to assist Plant Protection and Quarantine field operations and states in implementing specific action plans to manage infestations and prevent the spread of EAB to other locations. This information provides strategies for detection and response to an infestation of EAB by presenting available information for implementing general and delimiting surveys, identification, regulatory, control, containment, or eradication procedures. Specific emergency program activity should be based on information available at that time.

Plant Protection and Quarantine (PPQ) develops guidelines through discussion, consultation, or agreement with other Animal and Plant Health Inspection Service (APHIS) staff, State Plant Regulatory Officials, U.S. Forest Service, tribal governments, and other state and federal agencies and cooperators directly involved in EAB management.

Disclaimers

Document comprehensiveness: This document is not intended to be complete and exhaustive, but a foundation based on literature available to assist future EAB control efforts. Few publications were available at the time of this writing and not all specialists and members of the research community were consulted for their advice. As ongoing research and program efforts provide new information, the direction and strategies of the guidelines may change to reflect the best management practices for the control of EAB. For the latest updates on this pest, it is recommended to conduct a periodic literature search on the web and other archives.

Commercial Suppliers or Products: References to commercial suppliers or products should not be construed as an endorsement of the company or product by the U.S. Department of Agriculture.

Program Safety

Safety of the public and the program personnel has priority in preprogram planning and training, and throughout operations. Safety officers and supervisors must enforce on-the-job safety procedures.

Support for Program Decision-Making

The USDA/APHIS/PPQ Center for Plant Health, Science and Technology (CPHST) provides technical support, in consultation with other scientists, to emergency pest response program directors concerning risk assessments, survey methods, control strategies, regulatory treatments, and other aspects of the pest response program.

2. PEST INFORMATION

Systematic Placement

Phylum: Arthropoda
 Class: Insecta
 Order: Coleoptera
 Family: Buprestidae
 Genus: *Agrilus*
 Species: *planipennis*
 Entomological Author: Fairmaire, Léon Marc Herminie

Approved Name: *Agrilus planipennis* (Fairmaire)

Synonyms: *Agrilus marcopoli* (Obenberger 1930)
Agrilus marcopoli ulmi (Kurosawa 1956)
Agrilus feretrius (Obenberger 1936)

Common Names: emerald ash borer (English)
 agrile du frêne (French)
 изумрудная ясеневая златка (Russian)

Background Information

Emerald ash borer (EAB) is a non-native wood-boring pest of North American ash trees. This devastating pest was first found in 2002 in North America where it was discovered in southeastern Michigan and adjacent areas in Windsor, Ontario, Canada. It is thought to have been introduced in the 1990's on solid wood packing material originating from Asia.

This extremely destructive beetle poses an enormous threat to all of North America's ash resources. Unlike many other wood boring beetles, EAB aggressively kills healthy and stressed trees; many dying within two to three years after becoming infested. Currently, EAB has no known natural enemies in North America and no effective control options. If it is not contained or its effects mitigated, this pest will continue to infest and kill all species of trees in the genus *Fraxinus*. The impact on ash in North America has been compared to the effects of chestnut blight and Dutch elm disease, which devastated rural and urban forests in the 20th century.

Historical Information

Biological information on EAB is scarce. Prior to 2002, only two short papers occurred in the literature: Chinese Academy of Science (1986) and Yu (1992). These papers include brief morphology, biology, host range, and symptoms of infestation.

In Fiscal Year (FY) 2002, shortly after EAB was confirmed as the cause of significant ash tree mortality observed in Detroit, Michigan, five counties were found to be infested and were placed under quarantine.

Since that time, APHIS, Forest Service, state, and local cooperators have conducted survey, control, and eradication activities. Efforts have included imposing quarantines, conducting surveys, delimiting areas around confirmed infested sites, removing ash trees, and developing information which will support management efforts. Lack of effective survey and control technology has made containment efforts challenging.

Intensive visual survey efforts in FY2003 expanded this area by 12 additional counties in Michigan. After intensive survey efforts in northern Ohio, EAB was discovered there in three counties. Additionally, due to a 2002 Michigan quarantine violation involving nursery stock, control actions were implemented in Maryland and Virginia in 2003.

Survey methods were improved in FY2004 through the implementation of trap tree survey, a survey method less labor intensive than visual survey. This survey method, in combination with the visual survey methods, resulted in the discovery of 22 additional counties in 2004: 17 in Michigan, three in Ohio, and two in Indiana discovered in April and May.

In FY2005, one additional new detection was made in Indiana, five in Ohio, and 16 in Michigan which accounted for the 22 new county finds that year.

Illinois was found to be infested in FY2006; the first infested county was found in June, the second in July. This was in addition to 12 additional new county finds in Michigan, 11 in Ohio, and seven in Indiana, for a total of 32 new county finds for 2006. In addition, Maryland reported a re-infestation of a site that underwent eradication actions in FY2004.

Michigan found EAB in seven additional counties in FY2007. Indiana discovered five more infested counties and Ohio saw an increase of 11 more counties this same year. Two more counties were found to have EAB in Illinois and the state of Pennsylvania reported their initial infestation of two counties.

FY2008 currently has additional new reports of two counties each in Ohio and Indiana and a new infestation in one county of West Virginia.

The first state and federal quarantines began in 2002 with the original six infested Michigan counties. This area was expanded in 2003 to a total of 13 counties and two portions of counties in Michigan, four portions of counties in Ohio, and one portion of a county in Maryland.

At the end of 2004, 20 entire counties in Michigan were considered generally infested and quarantined; portions of 16 additional counties in Michigan, four counties in Ohio, and two counties in Indiana were quarantined due to small spot infestations caused by the anthropogenic movement of firewood, nursery stock, or timber. In 2005, the quarantine expanded to 21 entire counties and 25 partial counties in Michigan, four entire counties in Indiana, and one county and ten partial counties in Ohio.

By December, 2006, the entire Lower Peninsula of Michigan (68 counties) as well as one partial county in the Upper Peninsula, the entire states of Ohio, Indiana, and Illinois and a county in Maryland were federally quarantined to prevent the spread of this destructive pest.

On August 8, 2007 the federal quarantine was expanded to include four counties in Pennsylvania after discovery of an initial infestation in that state.

Economic Impact

The eastern United States produces nearly 114 million board feet of ash saw timber with a value of \$25.1 billion (McPartlan et al. 2006). White, black, and green ash make up over 7 percent of all hardwood species and 5.5 percent of all tree species in the northeastern United States and eastern Canada. The wood is used for a variety of applications including tool handles, wooden baseball bats, furniture, cabinetry, solid wood products, packing materials, pulp, and paper. The continued spread of this pest threatens these resources and may permanently alter landscape ecosystems of the Midwest, which consists of up to 20 to 40 percent ash in some areas.

There is potential for extensive negative economic effects if this wood-borer were to become widespread in the United States. If left unchecked, EAB will continue to infest and destroy ash trees, resulting in the losses of millions of dollars to the lumber and nursery industries as well as urban communities. Preliminary findings by USDA Forest Service estimate that EAB's potential impact to the national urban landscape is a potential loss of between 0.5 to 2 percent of the total leaf area (30-90 million trees) and a value loss of between \$20-60 billion (McPartlan et al. 2006).

Infested states may experience significant economic losses in forest products if EAB spreads from the currently quarantined area into the forests of the eastern United States. Quarantines imposed by state and federal agencies have negative impacts on the nursery, landscaping, timber, recreation, and tourism industries which are economically important to the region.

In addition to its value to the timber industry and the forest ecosystem, ash is one of the most popular landscape trees because of its wide ecological amplitude and resistance to other pests. It is the most commonly planted tree in new residential and commercial developments.

In an initial economic analysis of EAB, the USDA Forest Service estimated that EAB if not contained and eradicated, could cause approximately \$7 billion in additional costs to state and local governments and landowners to remove and replace dead and dying ash trees in urban and suburban areas over the next 25 years. Nationwide, the nursery industry produces an estimated 2 million ash trees each year. With median approximate values ranging from \$50 to \$70 per tree, the ash nursery stock crop is worth between \$100 and \$140 million annually (McPartlan et al. 2006).

Host Range

In North America, EAB is capable of infesting all ash trees in the genus *Fraxinus*, including green ash (*F. pennsylvanica*), white ash (*F. americana*), black ash (*F. nigra*), pumpkin ash, (*F. profunda*), blue ash (*F. quadrangulata*), and other native species in this same genus.

Chinese reports indicate that the species *F. chinensis* var. *chinensis*, *F. chinensis* var. *rhynchophylla*, and *F. mandshurica*. (Chinese Academy of Science 1986, Yu 1992) are native hosts in Asia.

In Japan, the host range includes Manchurian ash, (*Fraxinus mandshurica* var. *japonica*), Manchurian walnut (*Juglans mandshurica* var. *sieboldiana*, and var. *sachalinensis*), Japanese wingnut (*Pterocarya rhoifolia*) and Japanese elm (*Ulmus davidiana* var. *japonica*).

There is an isolated reference to privet (*Ligustrum spp.*) being suitable for 1st stage larval development in a laboratory setting (Cappaert et al. 2005).

Geographic Distribution

Native distribution of EAB in Asia includes several provinces of China (Liaoning, Jilin, Heilongjiang, Inner Mongolia, Hebei, and Shandong), Korea, Japan, Taiwan, and a small area in adjacent Russia and Mongolia (US Forest Service 2008).

EAB is now considered established in portions of the United States and Canada.

Biology

Current research suggests that EAB can complete either a one and two year life cycle. It has been observed that low density populations on vigorous ash trees tend to support a two year life cycle while stressed trees with higher beetle population densities tend to support a one year

life cycle (Cappaert et al. 2005). Effects on life cycle due to latitudinal and altitudinal variation are unknown at this time.

Life Cycle

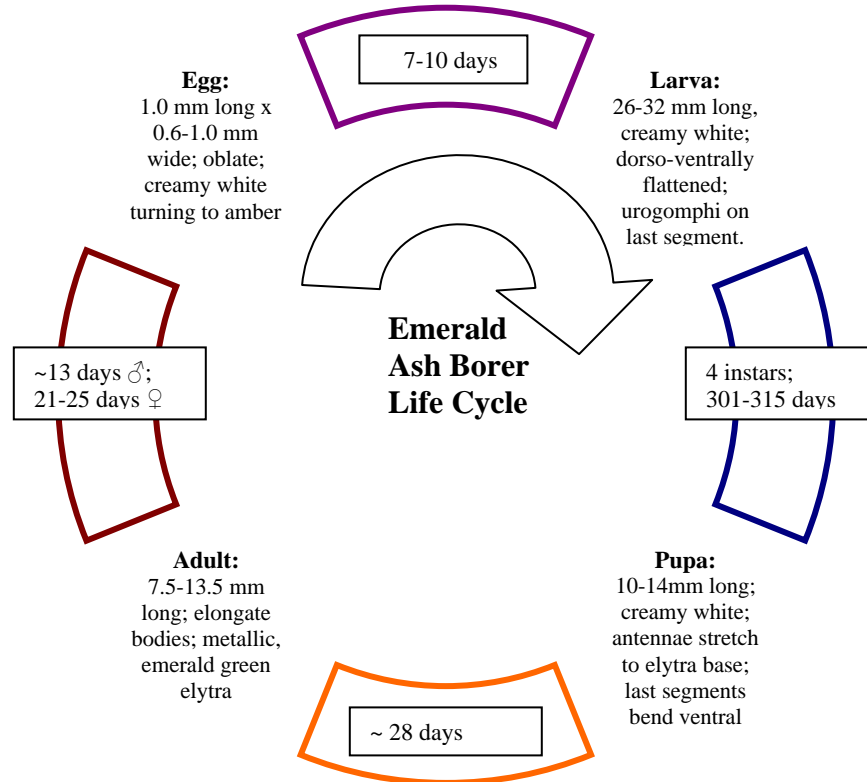


Figure 2.1 Emerald ash borer life cycle.

Eggs: Oviposition sites are likely to be correlated with the direction of sunlight, with the most eggs being laid on the southwestern side of the tree (Timms et al. 2006). Recent research indicates that females may prefer to lay eggs in areas where the bark is rough, cracked, or rippled, as may be found near branch crotches. The female may lay 1-23 eggs at a time, with one being the norm. Each female can lay 60-90 eggs in their lifetime, depositing them individually on the bark along the trunk and portions of the major branches. The eggs typically hatch in 7-10 days (Yu 1992).

Larva: Minute larvae bore through the bark and into the cambium where they feed on the phloem from mid-June to mid-October. There are four stages to larval development (Cappaert et al. 2005). As they feed, the larvae create long serpentine galleries (20-30 cm.) filled with frass, which enlarge in width as they grow. Larvae continue development until late summer/fall. Facultative diapause occurs after fourth instar larvae enter the sapwood or outer bark and excavate a pupal chamber where they overwinter as prepupae. Larvae too

immature to prepupate spend the winter in the larval gallery and complete development the following spring. Larval galleries are typically 20-30 cm long.

Pupa: Pupal development is variable according to humidity and temperature. Pupation may begin upon the accumulation of 100-150 growing degree days and, in ideal laboratory conditions, pupal development typically takes approximately 4 weeks. After pupae transform into adults, the beetle takes 1 to 2 weeks before it emerges through D-shaped exit holes 3-4mm wide. More research is necessary to fully understand pupal development.

Adult: Newly formed adults typically remain in the pupal chamber for 1-2 weeks after pupation is complete. Initial adult emergence predictively occurs when an accumulation of 400-500 growing degree days is achieved. Evidence of an adult emergence appears in the form of a D-shaped exit hole 3-4 mm in diameter. Emergence continues until late July with adults remaining active until mid-August. Peak activity for adults is predicted to occur at approximately 1,000 growing degree days. Adults are capable of immediate flight and, in laboratory conditions, adults mate shortly after emergence. An approximate 3 week period of maturation feeding occurs before oviposition. The adults feed on ash foliage, causing minimal damage. Adults may display thanatosis when frightened or disturbed. They are phototactic and thermotactic and most active on warm, cloudless, windless days. Oviposition begins 7-9 days after the initial mating (Yu 1992). Average longevity for adult males is 13 days; average longevity for females is 22 days (Bauer et al. 2004, Lyons et al. 2004, Poland and McCullough 2006). *Agrilus planipennis* beetles are strong fliers, with females flying twice as far as males and mated females flying twice as far as unmated females. Tethered flight in laboratory conditions suggests that a mated female may fly more than 20km (Taylor et al. 2006). Females may mate as many as 3 times with mating lasting 20-90 minutes (average of 60 min.).

Development

Many environmental factors can influence the development of insects, the timing of their biological events, and the dynamics of their populations. Among these factors are host availability, population densities, photoperiod, and weather. Temperature and moisture, because they are so critical to biochemical reactions, are universal influences on egg, larval, pupal and adult development in insects. Current research suggests initial adult emergence occurs when cumulative growing degree days reach 400-500 degree days with peak activity occurring at approximately 1000 growing degree days (McCullough and Siegert 2006). Temporal variation for these occurrences may exceed one month when considering latitudinal differences in the current quarantine area.

More research is necessary to further examine EAB biology, including developmental thresholds on the life cycle of the emerald ash borer.

Importance Accurate identification of the pest is pivotal to assessing its potential risk, developing a survey strategy, and deciding the level and manner of control and/or management.

Authorities For new detections in a state or county, the USDA-APHIS-PPQ's National Identification Service must positively identify the suspect pest as *Agrilus planipennis* before consideration of any containment, control, regulatory or eradication activities.

Identification Some pre-identification and screening can be performed by field personnel assigned to the program if training is provided. A description of EAB, *Agrilus planipennis*, including distinctive features that separate it from native species that resemble it, with pictures, is included in this document.

Description of the species, *Agrilus planipennis*

Eggs

Eggs are 1.0 mm long x 0.6 mm wide and oblate. They are creamy white turning to amber before hatching with a reductus extending radially toward the edges.



Figure 3.1 *Agrilus planipennis* egg on bark. Photo: Houping Liu, www.forestryimages.org

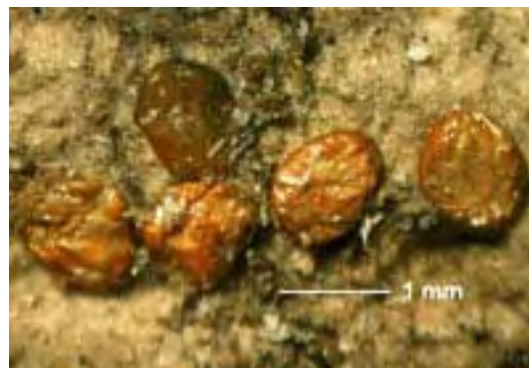


Figure 3.2 *A. planipennis* egg cluster. Photo: David Cappaert, Michigan State University



Figure 3.3 Unhatched *Agrilus planipennis* neonate on bark. Photo: Houping Liu, www.forestryimages.org

Larvae

Larvae are creamy white, and dorso-ventrally flattened. They are 26-32 mm long when fully mature in the fourth instar. The small, brown head is mostly retracted into the prothorax with only the mouthparts remaining visibly externally. The prothorax is enlarged with the mesothorax and metathorax more narrow. The mesothorax and each of the first eight abdominal segments have a pair of spiracles.



Figure 3.4 Three instars of *A. planipennis* larvae. Photo: David Cappaert, Michigan State University

There are ten abdominal segments. The first abdominal segment can be rectangular to trapezoidal shaped, but may vary greatly. Abdominal segments 2-7 are somewhat trapezoidal with protruding flattened lobes.



Figure 3.5 Anterior abdominal segments. Photo: James Zabltny, USDA APHIS PPQ

Abdominal segment 8 (A8) is distinctly bell shaped. The last abdominal segment (A10) contains a pair of urogomphi. Emerald ash borer prepupae are more difficult to identify, being subtly different than less mature larvae, but A8 is still bell shaped.



Figure 3.6 Posterior abdominal segments.
Photo: James Zablontny, USDA APHIS PPQ



Fig 3.7 *Agrilus planipennis* prepupal stage

Pupae

Pupae are creamy white and 10-14mm long. The antennae extend dorsally to the base of the wing buds. The posterior abdominal segments are slightly curved ventrally.

Figure 3.8 Pupal ventral and dorsal views
Photo: Deborah Miller, USFS (NC)



Adults

Adults have metallic (brassy or golden) green pronotum, with darker, metallic emerald green elytra and abdominal sternites. They may reach a



Figure 3.9 *Agrilus planipennis* adult. Photo: David Cappaert, Michigan State University

length of 8.5-13.5 mm long and 3.1-3.4 mm wide. The cuneiform body is narrow and elongate. The abdominal tergites are metallic coppery red. The head is flat with the vertex shield shaped. The compound eyes are obscure-aeuous and kidney shaped. The rectangular prothorax is slightly wider than the head, but the same width as the elytra. The anterior margin of the elytra is raised, forming a transverse ridge; the surface is covered with punctures. The elytra's posterior margins are round and obtuse with small denticles on the edge. There is an emarginate pygidial spine.

Similar Species

Agrilus is one of the largest genera in the world with almost 3000 described species. Species in this genus are difficult to identify because of structural coloration and subtle morphological differences between species.

Agrilus also is a very diverse genus with 171 known species in North America. North American species most similar to *Agrilus planipennis* are *A. bilineatus* (Weber), *A. obsoletoguttatus* Gory, *A. masculinus* Horn, *A. anxius* (Weber), *A. vittaticollis* (Randall), and *A. subcinctus* Gory.



Agrilus cyanescens Ratzeburg



Agrilus bilineatus (Weber)

Figure 3.10 *Agrilus cyanescens* and *A. bilineatus* adults



Agrilus bilineatus (Weber)



Agrilus anxius (Weber)

Figure 3.11 *Agrilus bilineatus* and *A. anxius* adults



Agrilus masculinus Horn



Agrilus vittaticollis (Randall)

Figure 3.12 *Agrilus masculinus* and *A. vittaticollis* adults

The only other *Agrilus* species in the Midwest besides *Agrilus planipennis* known to occur on *Fraxinus* spp. is *Agrilus subcinctus*. A major behavioral difference between *A. subcinctus* and *A. planipennis* is that *A. subcinctus* is a twig borer and prefers smaller branches for oviposition.

Collection and Preparation of Specimens

Collect as many specimens as possible of the pest for identification. Do not mix samples. Be sure to separate larvae into vials by tree or location. Collect additional information as noted:

- Fill out PPQ 391.
- Gather the following information about the tree:
 - State
 - County
 - Date
 - GPS Coordinates
 - Tree Diameter at Breast Height (DBH)

Prepare specimens according to the following protocols.

- ▣ Gather larvae/pupae from the same tree into the same vial.
- ▣ Label the vial with the naming protocol: Year-collector initials-Month-Date (for example: 06-PDB-10-29)
- ▣ Larvae should be killed in boiling water, allowed to cool, and placed in 70% ethyl alcohol or 70% isopropyl alcohol prior to shipping.
- ▣ If there are too many larvae/pupae, extras may be placed in alcohol in larger container (labeled completely)
- ▣ Ship vials in a well-padded box (be aware of possible restrictions on shipping alcohol by air carriers).

Large specimens or small specimens that have been crowded into one vial should be transferred to fresh alcohol within a day or two to reduce the danger of diluting the alcohol with insect body fluids. If the alcohol becomes too diluted, the specimens may begin to decompose.

Screening for Suspect Buprestidae and Specimen Submission

Any suspect Buprestidae adult or suspect EAB specimen collected from a trap in a **non-quarantined** state should be placed in a vial with 70% ethanol or 70% isopropyl alcohol and 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/or GPS coordinates on the PPQ form 391 so identified specimens can be linked to survey records.

Dr. James Zablotny
USDA, APHIS, PPQ
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 first state find confirmation.

Any suspect Buprestidae adult or suspect EAB specimen collected from a trap in a **quarantined** state should be placed in a vial with 70% ethanol and delivered to the State Plant Health Director or APHIS representative to be packaged and shipped to Dr. Bobby Brown along with a completed "Specimens for Determination" PPQ form 391. Be sure to include any survey record number and/or GPS coordinates on the PPQ form 391 so identified specimens can be linked to survey records.

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

Introduction Surveys support the program by providing information on the location, distribution, and movement of EAB. Surveys also function as a delimiting tool to determine scope and extent of current EAB infestations. Survey information provides the basis for management decisions and provides continuous assessment of the effectiveness of the quarantine and control activities.

Trace Back and Trace Forward Investigations Surveys are conducted to find new infestations and determine the extent of a known infestation. In the course of conducting surveys or carrying out regulatory activities, investigations of the movement of potentially infested articles can also be considered a survey activity. Trace back investigations are conducted to try to determine the source of an infestation and trace forward investigations help determine if further spread occurred due to movement of infested host material or means of conveyance.

Activities that may require investigations in an EAB program include the movement of nursery stock, logs, lumber, wood chips, pallets or firewood.

General Detection Surveys The purpose of a general detection survey is to determine if a pest exists in an area. Positive results indicate that a pest is present. Lack of a positive result is valuable for providing clues to dispersal, and temporal or spatial activity patterns of pests particularly when considered with positive results from similar areas or proximities.

Early detection of isolated infestations discovered during general detection surveys may provide an opportunity to eradicate if the infestation size is clearly identifiable and still manageable. The size of the infestation cannot be determined, however until a delimiting survey is conducted.

Current program survey methods for *Agrilus planipennis* include visual survey, the selection of host trees to create detection trap trees, and the selection of locations for the placement of panel traps. Visual survey may include tree-climbing for more extensive visual survey in the upper canopy. Detection trap tree surveys are based on stressing the tree to make it more attractive to EAB. Attractant-baited panel traps offer several advantages over trap trees including lower cost, uniformity of sampling unit, safety, fewer logistical problems, and more precision in sampling.

Destructive sampling is used to recover EAB larvae from suspect infestations identified from visual surveys and in detection trap

trees at the end of a season.

Attractant-baited panel traps have been determined to be the most effective and operationally efficient method of survey (Francesca et al. 2006). Aerial survey and remote sensing have not proven to be an efficient method of survey for EAB at this time.

Activities for conducting general surveys include:

- Planning, prioritizing, and procuring equipment and supplies for survey activities
- Developing or adapting existing protocols to meet new or unusual site-specific program needs
- Assisting scientists with the development and evaluation of new or improved survey protocols
- Following procedures for reporting new infestations and prompt specimen identification
- Maintaining survey records and maps
- Reporting survey results to management officials in a timely fashion

Many EAB infestations have been found by the public. As such, a strong outreach program is crucial for survey to be utilized efficiently.

Initiating a Detection Survey

APHIS and state cooperators will determine what legal authorities exist for rights-of-access to ash trees for use in survey and trapping activities. Primarily, panel trap trees, detection trees, and trees for destructive sampling will be located in areas with easy and clear rights-of-access for survey personnel. In addition to the rights-of-access authority of state departments of agriculture, other cooperators who may agree to provide access include, but are not limited to, state departments of natural resources, state departments of transportation, county boards of supervisors, conservation districts, federal and state land managers, and public park managers.

Survey areas will be defined by using various sized survey grids or other survey units, dependent on ash density models, risk, and other information. The choice of the strategy will be dictated by existing survey guidelines, existing infestation size, land use patterns, pathway analysis, and any other information relevant to effective survey methodology.

Standard density recommendations for panel trap and/or detection tree survey suggest a minimum one panel trap and/or detection tree placed in each grid square. (Acceptable grid densities vary and

are determined by site variables and program and environmental factors)

Survey personnel also will identify high risk sites using available information sources such as aerial photographs, road maps, plat maps, and ash density maps. Survey sites are identified in each grid square or survey unit and individual tree inspections will be conducted by carefully examining trees for EAB presence and/or symptoms before selecting as a panel trap tree or detection tree.

Local law enforcement should be notified of survey efforts to increase public awareness and ensure safety of survey crews. Local agricultural extension agents should also be notified so they may be prepared with current information to share with the public.

Survey Site Selection

Site selection should be coordinated with State Plant Regulatory Officials (SPRO), tribal governments, and other federal, state, local government and private organizations involved in the program. Examples of high risk sites suggested for trapping activity outside a grid-defined survey zone are listed below in order of priority:

1. Declining ash (Ash trees exhibiting two or more of the symptoms listed below should also be examined using destructive sampling techniques.):
 - Canopy stress/dieback
 - Epicormic shoots/suckering
 - Bark splits
 - Woodpecker damage
 - D-shaped exit holes (3-4mm diameter)
 - Serpentine larval galleries
2. Campgrounds, recreation areas, cottage communities, summer camps
3. Nurseries, sawmills, arborist/landscape firms and firewood dealers
4. Recently landscaped residential and commercial properties
5. Sites of high attendance/ high profile cultural events: pow wow grounds, hunting lodges, NASCAR race tracks, horse trail ride sites, motor cross sites, rafting guide huts, fishing camps, etc.
6. Major transportation arteries, rest areas
7. Waterways and fencerows
8. Rural residences

Visual Survey

Although visual survey is not recommended as a primary survey tool for early detection, it can be helpful in locating older (3-5 yr.) infestations. Visible symptoms are difficult to determine in early

infestation stages with no visible symptoms in the first year of infestation. Visual survey may only detect trees that have been infested for three or more years. Early stages, which show few signs of infestation, will not be detected by visual survey alone. Panel traps or detection trees are required to detect early stage infestations. On larger trees, symptoms may be present only in the upper canopy in the early stages of infestation. In special instances, tree climbers may be used for a more intense inspection than a visual survey would provide from the ground.

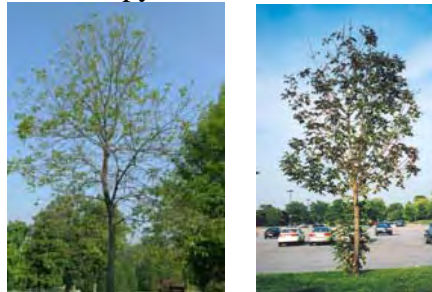
Trees with D-shaped emergence holes, serpentine galleries, or with a verified life stage of *Agrilus planipennis* collected will be considered positive for EAB infestation. They should be marked and their location recorded with GPS coordinates.

Trees in a state of decline or with a combination of other symptoms should be examined more closely with a tree climber or a destructive sampling technique. If no life stages, exit holes, or serpentine galleries are found, the tree will be considered negative for data recording purposes.

Symptoms of EAB Infestations

Symptoms of *Agrilus planipennis* infestation to be cognizant of when conducting visual surveys include:

- Canopy stress/dieback



- Epicormic shoots/suckering



Figure 4.1 Symptoms of EAB on *Fraxinus spp.*

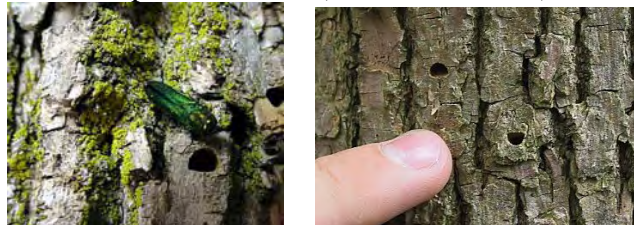
- Bark splits with larval galleries underneath



- Woodpecker Damage



- D-shaped exit holes (3-4mm diameter)



- Serpentine larval galleries



Figure 4.2 Symptoms of EAB on *Fraxinus* spp.

**Setting Panel
Traps**

Trap Density: A trap should be placed within each square of the specified grid where ash is found growing. Traps should be spaced as evenly as possible within the grid taking into consideration easy access to roads and the presence and condition of ash trees. (High risk sites within the specified grid should be targeted and prioritized as a trap location)

Lure: A Manuka oil lure with a 50 mg/day release rate is recommended. In addition, a leaf volatile blend in dispensers may also be used depending on available resources. The Manuka lure provided by commercial firms is produced as a pouch that is designed to last in the field for 60 days. The leaf blend lure will be in dispensers and has approximately half the field life of Manuka oil. Directions for hanging lures are provided below in the Trap Placement section.

Trap Placement: Traps should be placed in or near host ash trees. Preferably, trees should be 8" or greater in DBH (larger or largest ash tree in a stand of trees is preferred). Also, trees should be located along edges or in open areas, or in open stands such as parks. Traps should be placed in the lower to mid-canopy or as high as possible, but no lower than 5 feet above the ground. They should be placed on the sunny side of the tree, most typically the south side.

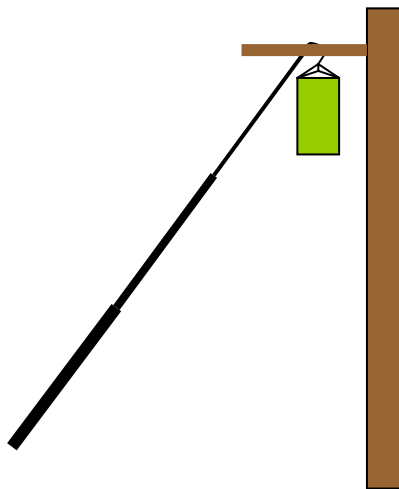


Figure 4.3 Trap hung using a telescoping pole.

Traps should be hung as high as possible from a branch or limb. A wire hanger will be used to facilitate trap hanging. A telescoping

pole can be fitted with a hook to place the trap in one of the lower limbs. The full extension of the pole may be necessary. If all limbs are too high for trap placement, a throw line may be tossed over a limb, and a rope and trap may be hoisted up into the lower canopy (Fig. 4.4).

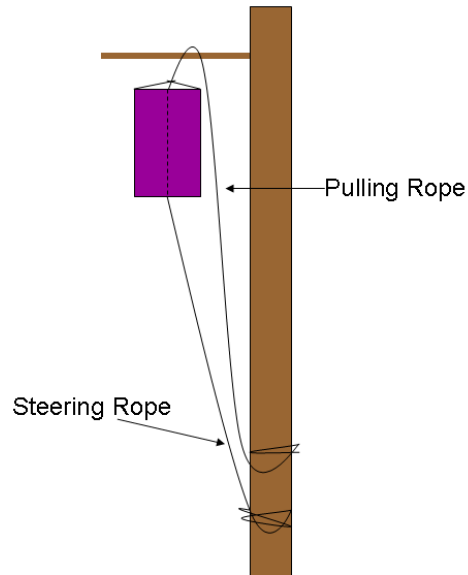


Figure 4.4: Trap hung using a rope

If it is not possible to place traps high, then traps should be hung along the edge of an ash stand, as close to ash trees as possible. They can be attached to an ash tree using the tree trunk hanger (Fig. 4.5) with the top of the trap 4.5 feet above the ground.



Figure 4.5 Trap hung from tree trunk hanger strapped to a host tree.

Research suggests that an accumulation of 450 growing degree days (base 50°F) results in initial emergence of EAB adults. This same research suggests that in the 900-1100 growing degree days range EAB adult activity reaches a peak. Traps should be placed prior to 450 growing degree days and lure replacement is recommended to occur just prior to projected peak activity. In order to assist states with trap placement and lure maintenance, maps of the Continental U.S. depicting predictive bands of initial emergence and peak activity will be available at:

http://www.aphis.usda.gov/plant_health/plant_pest_info/emerald_ash_b/index.shtml

Trap Maintenance: Traps should be checked at least once during the season. Lures will last approximately 60 days, so depending upon how far in advance of EAB flight traps are deployed, the lure may need to be replaced halfway through the season. (Timing of placement and/or revisiting the trap should consider the predicted growing degree day initial emergence date and peak activity date to plan for placement or revisiting to rebait trap prior to that date)

If trap surfaces are loaded with debris, they should be renewed by removing the debris and combing the glue. Combing can be accomplished with a toothed trowel or a serrated putty knife. If necessary, glue can be added by rolling it on using a paint roller.

Trap Disposition: Traps should be removed late August or after accumulation of 1500 growing degree days. Traps are recyclable and their resin identification code is “5” for polypropylene (PP). It should be noted that polypropylene material may not be accepted at some municipal recycling centers. A list of polypropylene recyclers by state may be found at:

<http://www.recyclingplasticwaste.com/recyclers/usa/pp/>. Since some glue residue and debris will be persistent, it is recommended to consult your recycler. Hangers and spreaders are reusable and should be retained for future use.

Trap Data Management Structure: PPQ wants to make it clear that utilization of the National “Integrated Survey Information System” (ISIS) as a field data collection tool is not required. We do believe however that operationally specific data is of great importance and therefore have designated the ISIS application to be utilized as the final holding tank (centralized database) for this data.

The ISIS database is housed inside the APHIS network and is accessible to employees who have direct access to the APHIS network and to co-operators with APHIS VPN accounts. After receiving network access and a username and password for ISIS, users can log into the systems and utilize any (or all) of the three (3) data entry tools. These tools include; a web interface, a web upload tool, and a PDA (Hand Held Computer) software application.

We encourage users to use the PDA portion of ISIS, but understand organizations have existing tools and/or applications used to collect data in the field. Organizations utilizing methods other than the PDA (paper, spread sheets, or third party software platforms) can enter data directly into the web interface or “bulk” upload data from flat file spread sheets using the web upload tool.

While most issues surrounding connectivity have little to do with ISIS, (but more to do with government security requirements) the ISIS team understands unique connection situations still exist. In these cases, we will make every accommodation and, if needed, upload the data into the system. The ISIS team is always available to discuss end user needs and/or other solutions available regarding data collection and data management issues. Assistance and support is available from the ISIS help desk at the following:

National Support

Email: ISIS.Support@aphis.usda.gov
1-866-910-9091

ER ISIS Support

LaWan A. Foster
lawan.a.foster@aphis.usda.gov
919-855-7754

WR ISIS Support

Ryan J. Reynolds
ryan.j.reynolds@aphis.usda.gov
970-494-7557

Survey Data Elements and Templates: Data Elements were determined from: National, Eastern, and Western Regional Program Managers, as well as, the 2008 EAB Survey Guidelines Document. If users have any questions regarding elements and templates, please contact the ISIS help desk.

**Creating a
Detection Tree**

Girdled detection trees provide a better method of detection of low density EAB populations than visual survey but are more costly than panel traps.

Girdling involves disrupting the tree's ability to transport nutrients by removing a band of bark and phloem around the trunk. As the tree becomes increasingly stressed, chemicals emitted from the tree change. There is also a difference in the wavelengths of light reflected by the leaves of healthy vs. girdled trees. Beetles may be more attracted to the girdled trees than non-stressed healthy ones.

The operation of the detection tree technique is labor intensive and more costly than panel traps. Install detection trees in accordance with the degree of risk presented.

Survey personnel will use county-level maps to locate pre-assigned sites for trap tree placement, locating a qualifying ash tree as close to this point as possible. Tree placement will depend on local land access rights and agreement with the cooperating states. Typically interstate, U.S and State Highway, rights of way are preferred; county road rights of way may be used in their absence. Permission from land owners may be sought if no rights-of-way are suitable.

Since EAB seems to demonstrate a preference for some ash species over others, when multiple ash tree species are present, it is best to select the species most likely to attract EAB. It is recommended to select ash tree species in the following order: 1) green ash (most preferred), 2) black ash, 3) white ash, and 4) blue ash (least preferred).

Adult beetles are more active in sunny, warm locations and are attracted to light; the degree of exposure of the tree should be taken into consideration. Open grown trees are most preferred; a hedgerow tree (exposure on 2-3 sides) is acceptable. An edge tree (exposure on 1-2 sides) is less preferred; a closed canopy tree is the least preferred. All trees should be naturally occurring, if possible.

Detection trees ideally should be no larger than 8 inches diameter and no smaller than 4 inches diameter. Smaller trees may break in the wind; larger trees will be difficult to fell, peel, and remove. If possible, smaller trees that are overtopped by larger trees should be avoided.

Detection trees should not be established in areas where removal

will be difficult (i.e. near power lines). Trees that may cause damage or injury if they break should not be used. A distance of at least two times the height of the detection tree should be established between the tree and any safety hazard, including but not limited to campsites, picnic tables, frequently used trails, or any other feature that could cause harm by a falling tree.

Trees must be girdled prior to initial adult emergence (cumulative 450° growing degree days) in order for the trees to exhibit sufficient stress by peak EAB activity period.

Once a suitable tree has been identified, a visual inspection for EAB symptoms will be performed. The tree will then be girdled using a draw knife to remove all bark encompassing the entire circumference of the tree from an area approximately 6 inches in length and 4 feet from the ground. A 12 inch band of shrink wrap material will be wrapped, as high on the trunk as possible, around the tree. The wrap will be coated with a sticky insect trapping substance.



Figure 4.6 Method for creating a detection tree

The tree will be marked with flagging tape or paint and a tag will be attached that identifies the tree as a “Cooperative Emerald Ash Borer Response Project Monitoring Tree”. The tag should also provide a program contact number and website, if available, for the public to obtain more information.

A data point will be taken with GPS coordinates and recorded as “detection tree placement”. The exact location of the detection tree will also be marked in the county map book. Other data to record may include:

- Tree species
- Tree DBH
- Environment (woodlot, fence row, etc.)
- Physical address
- Date of girdling
- Surveyor name
- Relative ash density

All detection trees will be removed before pupation. Survey personnel will cut the tree and peel all bark from trunk and limbs >1” in diameter to inspect for *Agrilus planipennis* life stages. The sampled tree will be chipped or disposed of in the presence of survey personnel.

If no suitable tree is located within the targeted detection tree survey area, sentinel trees may be placed. Sentinel trees are landscape trees which are planted and may be stressed by placing them in a shallow hole or girdling. They will later be removed and the bark stripped for careful examination for EAB life stages.

Destructive Sampling

Destructive sampling is a means to detect EAB in a tree which, based on a visual inspection, may show clear symptoms of infestation, may show unclear, but suspect symptoms, or is a detection trap tree at the end of the season that requires examination to determine if it is infested with EAB.

Destructive sampling involves peeling bark from the tree to inspect for serpentine galleries or *Agrilus planipennis* life stages. This should be done over bark cracks or suspicious exit holes. There are different ways this method may be employed: “windows” (a rectangular or square section of bark) may be peeled, entire limbs may be removed and peeled, or the entire tree may be felled and peeled. The preferred method is to fell and peel the entire tree. Unless the tree or branch will be removed, care should be taken to ensure survival of the tree. All of these activities can mar the aesthetics of private and public settings so clear communication needs to occur with property owners prior to survey work. Disposal options must also be considered.

For optimal detection capability, special attention should be given when destructive sampling is done in the late summer and early

fall months, as the first larval instars are especially difficult to detect due to their extremely small size.

Preferred Order of Techniques for Destructive Sampling

Visual survey from the ground should be done before each of these techniques.

1. Fell entire tree and perform whole tree peel.*
2. Fell entire tree and perform less than whole tree peel.*
3. Climb the tree or use pole saw from the ground to cut out limb(s) that can be peeled on the ground.* (Note possible future liability may exist due to wounding and subsequent problems.)
4. Climb the tree and cut inspection windows.* (Note possible future liability may exist due to wounding and subsequent problems.)
5. Climb the tree and perform visual inspection.**
6. Cut windows from the ground.*

*Permission from the property owner must be obtained and disposal options must be considered.

**Permission from the property owner must be obtained.

Delimiting Survey

The purpose of a delimiting survey is to gather population density and dispersal information that will assist in planning a strategy for management.

Once an initial detection is made and a control or management program is to be initiated, a delimiting survey will be conducted to delineate the extent and distribution of the infestation. All land within a program specified radius of the initial find will be surveyed. Program activities have used the following grid sizes: 50-x-50 m, 100 x 100 m, and a five acre grid size. Evidence is not conclusive on optimum size for grid parameters. Destructive sampling should be used to assist in finding non-symptomatic infested trees. Survey areas may need to be expanded as more EAB are found.

If emergency personnel are to be used, a training session for all participants should be organized. Information covered should include recognition of EAB life stages, damage symptoms, ash tree identification, description of infested site and survey methods, data collection protocols, and safety considerations.

**Monitoring
Survey**

The purpose of a monitoring survey is to evaluate the effectiveness of an action to contain, suppress, or eradicate EAB. Use the same survey tools used for delimiting surveys. Monitoring surveys should be done around eradication sites for three years.

**Survey Sample
Collection**

Please refer to instructions provided in Section 3. Identification.

**Quality Control
for Survey
Activities**

Survey activities will be subjected to quality control monitoring. Quality control techniques will include resurvey of a percentage of the sites, analysis of survey data, and by direct observation. Other methods to assure sensitivity and selectivity as well as the quality of the techniques employed should be developed.

5. REGULATORY PROCEDURES

Instructions To Officers

Officers must monitor and certify regulatory treatments or other procedures when authorizing the movement of regulated articles. Only authorized treatments may be used in accordance with agency manuals and/or labeling restrictions.

Authorities

The Plant Protection Act of 2000 (Statute 7 USC 7701-7758) provides authority for implementation of emergency quarantine action. This provision is for interstate regulatory action only; intrastate regulatory action is provided under state authority. State departments of agriculture normally work in conjunction with federal actions by issuing their own parallel hold orders and quarantines for intrastate movement. However, if the U.S. Secretary of Agriculture determines that an extraordinary emergency exists and that the measures taken by the state are inadequate, USDA can take intrastate regulatory action provided that the governor of the state has been consulted and a notice has been published in the *Federal Register*. If intrastate action cannot or will not be taken by a state, then PPQ may find it necessary to quarantine an entire state.

The Federal Emerald Ash Borer (EAB) Quarantine (7CFR 301.53) provides the authority to conduct regulatory activities. In addition to the Federal Quarantine, individual states have established state quarantines regulating intrastate movement of regulated material in accordance with federal regulations.

PPQ works in conjunction with state departments of agriculture to conduct surveys, enforce regulations, and take control actions. PPQ employees must have permission of the property owner before entering private property. Under certain situations during a declared extraordinary emergency or if a warrant is obtained, PPQ can enter private property in the absence of owner permission. PPQ prefers to work with the state to facilitate land access. However, each state government has varying authorities regarding entering private property. A general Memorandum of Understanding (MOU) developed between PPQ and each cooperating state refers to how cooperative program activities are conducted. For clarification, check with your USDA Program Manager, State Plant Health Director (SPHD) or State Plant Regulatory Official (SPRO) in the affected state.

Regulating the Spread of EAB

The rate of natural spread by adult flight of *Agrilus planipennis* is estimated to be approximately 800 meters per year (Taylor et al, 2004). However, unpublished data suggests that this rate may be much higher and variable due to environmental factors and population density. Tethered flight in laboratory conditions predicts that a mated female

may fly more than 20 km (Taylor et al. 2006). Regulatory measures are necessary to prevent artificial spread through the transportation of *Agrilus planipennis* in firewood, logs, timber and other wood materials. Quarantine regulations typically prohibit the movement of potentially infested host material out of the infested area or require treatments, inspections, or other mitigating measures.

Regulated Articles

Regulated articles for *Agrilus planipennis* include:

1. The emerald ash borer (all life stages)
2. Firewood: all non-coniferous species
3. Nursery stock, green lumber, and other material living, dead, cut or fallen including logs, stumps, roots, branches, and composted and uncomposted chips of the genus *Fraxinus*.
4. Any article, product, or means of conveyance not listed above if an inspector determines that it presents a risk of spreading emerald ash borer and notifies the person in possession of the article, product, or means of conveyance that it is subject to the restrictions of the regulations.

Approved Regulatory Treatments

Approved regulatory treatments are determined by program management and/or a Technical Advisory Committee.

Table 5.1. Interstate movement of regulated articles from quarantined areas.

Regulated Article	Mitigation and Treatment Measures
Firewood of all hardwood species	<ul style="list-style-type: none"> • Remove bark and an additional ½ inch of wood¹ or • Kiln sterilization treatment (T404-b-4) or • Heat treatment (T314-a) in a heat treatment facility approved by APHIS or • Fumigate according to treatment schedule T404-b-1-1 (Methyl bromide fumigation at NAP-tarpaulin or chamber) or • Apply an APHIS approved method.
Chips and Mulch of all hardwood species	<ul style="list-style-type: none"> • Chip or mulch to less than one inch in at least two dimensions or • Follow an APHIS approved mulching or composting protocol or • Apply an APHIS approved method.
Nursery Stock of <i>Fraxinus</i> spp. Itself	No treatment available. No compliance agreements. No certification. This article is not being moved at this time.
Green lumber of <i>Fraxinus</i> spp. itself	<ul style="list-style-type: none"> • Remove bark and an additional ½ inch of wood¹ or • Kiln sterilization treatment (T404-b-4) or • Fumigate according to treatment schedule (404-b-1-1 (Methyl bromide fumigation at NAP-tarpaulin or chamber) or • Apply an APHIS approved method.

Logs of <i>Fraxinus spp.</i> itself	<ul style="list-style-type: none"> • Remove bark and an additional ½ inch of wood¹ or • Kiln drying treatment (T404-b-4) or • Heat treatment (T314-a) in a heat treatment facility approved by APHIS or • Fumigate according to treatment schedule T404-b-1-1 (Methyl bromide fumigation at NAP-tarpaulin or chamber) or • Apply an APHIS approved method.
Other material including wood waste, living, dead, cut or falling including stumps, roots, branches of <i>Fraxinus spp.</i>	<ul style="list-style-type: none"> • Chip or mulch to less than one inch in at least two dimensions or • Apply an APHIS approved method.
WPM containing regulated green lumber, including but not limited to , dunnage, crating, pallets, packing blocks, drums, cases, and skids.	<ul style="list-style-type: none"> • ISPM accredited treatments or • Treatment/mitigations for green lumber of <i>Fraxinus spp.</i> itself as listed above or • Apply an APHIS approved method (including ash segregation/exclusion)
<p>¹ The bark and wood removed will be regulated separately. If intended for interstate movement the removed bark and wood must be treated as described in Table 1 for chips and mulch. If produced at a mill located outside the quarantine area but approved to handle green ash logs or lumber from within the quarantine area, wood waste must be treated or destroyed prior to adult flight season.</p>	

Detailed specifications for treatments can be found in the current edition of the PPQ Treatment Manual online at:

http://www.aphis.usda.gov/import_export/plants/manuals/ports/treatment.shtml

Quarantine Boundaries

Quarantine area will be determined in consultation with state authorities based on the following factors:

- Anthropogenic (passive) dispersal
- Natural (active) dispersal
- Ease of enforcement due to geopolitical boundaries
- Historical and existing quarantine practices

Regulatory Management of Outlying Infestations

Isolated infestations outside of the quarantined area are common occurrences in pest management programs. These isolated infestations generally represent anthropogenic dispersal of *Agrilus planipennis* created by human movement of infested articles.

Regulatory management of outlying infestations will be handled using the following procedures:

1. Upon confirmation by a USDA EAB identifier and with consensus

from the cooperating regulatory agencies, a quarantine will immediately be established. The quarantined area may be adjusted based on additional survey information.

2. A delimiting survey will be initiated as soon as possible to establish the area of impact.
3. Provisions of the temporary quarantine will be the same as those established in the formal quarantine. Newspapers and direct mailings will be used to notify inhabitants within the established area that a temporary quarantine is in effect.
4. If the cause of the outlying infestation is not readily determined, trace back inspections and interviews with local business and home owners will be conducted to determine the source. These inspections will begin at the epicenter of the infestation and work outward. Trace forward inspections will be conducted to determine if infested host material has been moved out of the area. These inspections should include all establishments located in and/or conducting business within the regulated area.

Regulated Establishments

Field personnel will attempt to detect the pest within the regulated area at all establishments where regulated articles are sold, grown, handled, moved, or processed. Involved establishments might include, but are not limited to:

- Campgrounds
- Firewood dealers
- Nurseries
- Logging/lumber companies
- Pallet manufacturing companies
- Landscapers and garden centers
- Utilities companies
- Tree removal companies
- Municipality forest services
- Waste removal companies

Principle Regulatory Activities

Regulatory activities are directed at implementing and enforcing quarantine provisions governing movement of regulated articles which could result in artificial spread of *Agrilus planipennis*. Typical activities include:

1. Identifying persons and establishments whose business or personal activities could result in the further dispersal of *Agrilus planipennis*. (See Regulated Establishments, above.)
2. Contacting by regulatory visit, mail, email, and/or telephone those identified persons or establishments to explain quarantine provisions.
3. Determining if provisions of the quarantine (e.g., treatment or processing) may be applied to permit the person or establishment

- to move regulated articles out of the quarantined area.
4. Conducting inspections of regulated articles and monitoring procedures to mitigate pest risk on a shipment by shipment basis.
 5. Issuing Limited Permits (PPQ form 530) to allow movement of regulated articles out of the quarantine area to a specific destination for further processing or treatment.
 6. Issuing Certificates (PPQ form 540) to allow movement of regulated articles out of the quarantined area when they have been treated or processed in such a manner that they no longer present a risk for further dispersal of *Agrilus planipennis*.
 7. Entering into a Compliance Agreement at the discretion of the inspector with a person or establishment that can demonstrate their ability to meet the provisions of the quarantine.
 8. Conducting periodic physical site visits to monitor the activities of those persons or establishments placed under a Compliance Agreement to observe and assess treatments or other processes and activities. Periodicity of monitoring is based on risk assessment of the product and the business or individual under compliance.
 9. Conducting and/or assisting with investigations of suspected violations of the quarantine as necessary and appropriate.
 10. Recording information about contacts, visits, and Compliance Agreements and maintaining data on persons or establishments affected by the quarantine.
 11. Reporting results of regulatory activities to management officials on a weekly basis.
 12. Conducting special regulatory operations.
 13. Researching local and interstate trade movement to determine pathway risk.

**Investigations
and Violations**

When regulated material is suspected to have been moved out of the regulated area in violation of the quarantine, regulatory personnel will conduct initial preliminary investigations to determine if a violation of the quarantine has occurred and safeguard any regulated material. These investigations will also attempt to identify and to trace the source and destination of any other related shipments of regulated materials that have occurred.

Preliminary investigations by regulatory personnel will allow management to determine whether the situation warrants additional formal investigation by USDA-APHIS-Investigation and Enforcement Services (IES) personnel.

**Regulatory
Records**

All data related to regulatory activities will be maintained electronically on the regulatory database. Regulatory personnel will record information such as:

1. Date of visit
2. Purpose of visit (routine, investigation, monitoring) and actions taken/needed
3. GPS coordinates of the site
4. Name and address of contact
5. Phone, fax, and/or e-mail of contact
6. Communication method
7. Type of contact
8. Compliance agreement number (if applicable)

Weekly status reports will be made by regulatory personnel to EAB management officials summarizing their activities and highlighting immediate and developing problems.

Quality Control

Management officials will review the results of visits, contacts, and Compliance Agreements maintained by regulatory personnel to ensure that program standards are followed. A percentage of establishments operating with or without a Compliance Agreement will be selected for a paper audit on a regular basis. This is important to reinforce the effectiveness of a Compliance Agreement.

Outreach

Outreach is a vital component of every aspect of the EAB program. Without public support and cooperation, the efficacy of the program is very limited. Regulatory personnel should utilize opportunities during general regulatory activities and special regulatory operations to inform the public about the EAB program and enlist their cooperation.

**Special
Regulatory
Operations**

Another aspect of regulatory activity is to identify and conduct special operations to serve as deterrents and quality control for movement of regulated articles. These operations also give unique opportunities to inform the public of the pest and related regulations. The operations may be conducted with state cooperators. Special regulatory operations may include:

- Highway operations in cooperation with local law enforcement which stop traffic to inspect for movement of regulated articles by private citizens and commercial dealers and to increase public awareness.
- Rest stop and weigh station operations to monitor quality control.
- Ride along operations with law enforcement to regulate and ensure commercial enterprise compliance.
- Campground operations to regulate the movement of firewood from quarantined areas.
- Ferry operations to monitor the movement of regulated articles.

- Special focus operations to concentrate regulatory activities in a smaller area of interest.

**Issuing an
Emergency
Action
Notification**

After an initial suspect positive detection in a new area outside a quarantined area, an Emergency Action Notification (PPQ form 523) may be issued to place a hold on regulated material or facilities where regulated material may be found pending positive identification by a USDA-APHIS-PPQ recognized authority.

An Emergency Action Notification (EAN) may also be issued within the quarantine area to order a hold, treatment, destruction or other safeguarding action for a regulated material due to a potential pest risk. The EAN may be completed by hand in the field, but must be transferred into the EAN database within 14 days

**Removing areas
from Quarantine**

Project managers identify and remove areas from quarantine requirements after *A. planipennis* is declared eradicated. Quarantined areas will be released following three years of negative survey after eradication is declared. Release of the quarantined area will occur with the consensus of the cooperating regulatory agencies. APHIS will publish a Notice of Quarantine Revocation in the Federal Register when areas are removed from quarantine requirements.

**Regulatory
Forms**

Sample compliance agreement templates can be found at the following link:

http://www.aphis.usda.gov/import_export/plants/manuals/ports/treatment.shtml

Other sample regulatory forms and useful documents are located in the Appendices and include:

- Info Packets
- Regulatory Operation forms
- Sources to find regulatory concerns
- PPQ 518 form (Report of Violation)
- PPQ 530 form (Limited Permit)
- PPQ 540 form (Certificate)
- PPQ 523 form (Emergency Action Notification)

Overview

The Emerald Ash Borer Program is transitioning from an eradication program to a management program. Effective and cost efficient control technologies are not currently available to apply area-wide to effect pest eradication. In the future additional tools may become available to suppress the active dispersal of the pest. Program partners are conducting extensive research to provide additional tools and methodologies.

In this section we are providing the program policy on management of isolated infestations and currently available information on control and management tactics. We hope this will assist states, local communities, and the public in mitigating the effects of this destructive pest.

As research is ongoing in this area, management procedures will be subject to frequent changes. Please contact the EAB Program Director to ensure that procedures are up to date before implementing management measures.

Management Strategy

Management Policy Guidelines outside the current leading edge:

All new finds outside the leading edge will be evaluated individually and any management action will be considered only after all the following criteria are met:

1. The outlier must be a single, clearly identifiable regulatory incident. This may include nursery stock, firewood, or other regulated material transported beyond the current buffer.
2. The population, using dendrochronology and a delimiting survey, must be demonstrated to be less than two years old or to have no more than one population release from the original host material.
3. The population, using current technologies and methodologies, must be identified as eradicable by the EAB Management Team (*i.e.*, the point of introduction clearly identified and age of infestation as delineated in item 2).
4. The EAB Management Team may consider control cuts for EAB populations older than two years if circumstances indicate eradication may be achieved or the control action is determined to be strategically important for slowing the spread.

Community Preparedness Planning

Since control options to eradicate or prevent spread are not effective at this time, it is recommended that communities take action to prepare for an infestation of emerald ash borer.

An example of a community preparedness plan may be found at:

http://www.emeraldashborer.info/files/EAB_Preparedness_Plan_Final.pdf

Other states and communities have plans for addressing the emerald ash borer problem. These can be found at:

http://www.aphis.usda.gov/plant_health/plant_pest_info/emerald_ash_b/index.shtml

Forest management experts suggest taking preventive measures. Diversify landscape plantings, such as using the 30:20:10 rule: The urban forest should be composed of no more than 30% of the same family, 20% of the same genus, and 10% of the same species. Choosing native species over non-native species is recommended in order to reduce costs associated with maintenance. Ash (*Fraxinus spp.*) should be avoided as landscape plantings near infested areas/states.

Models exist for ash phloem reduction in managed forests/woodlots. One such model can be found at: <http://www.ashmodel.org/> Reduction of ash populations should be considered in consultation with forest management experts.

Biological Control In order to be a successful biological control agent, the following traits are desired:

1. Parasitoid
2. Multivoltine
3. Monophagous

Three parasitoids are currently under evaluation by APHIS. These parasitoids are known to attack EAB consistently in its native range in China. The biocontrol agents include one larval ectoparasitoid, *Spathius agrili* (Hymenoptera: Braconidae) (Yang et al. 2005), one species of egg parasitoid, *Oobius agrili* (Hymenoptera: Encyrtidae) (Zhang et al. 2005), and one species of larval endoparasitoid, *Tetrastichus planipennis* (Hymenoptera: Eulophidae) (Liu et al. 2003; Yang et al. 2006).

Research on EAB biological control began in 2002 when this destructive beetle was first found in Michigan. Much of the biocontrol research was done in China, where studies of EAB led to the discovery of three specific natural enemies: *Spathius agrili*, *Oobius agrili* and *Tetrastichus planipennis*. These natural enemies are tiny stingless wasps that seek and kill EAB eggs and larvae. Five years of research led to an environmental assessment of field release of these natural enemies. After a 60-day public comment period and a “Finding of No

Significant Impact”, APHIS and the State of Michigan approved release of these wasps for control of EAB. Small-scale releases were completed in Michigan in 2007. The sites will be monitored for establishment of the natural enemies and evaluated for their potential to control and slow the spread of EAB in the United States.

An EAB biocontrol laboratory is being established at the APHIS facility in Brighton, Michigan. Tools and techniques for rearing natural enemies will be further developed at this location with the goal of future distribution to other states. Over the next five years, specific release sites will be designated for research and tracked to collect data to determine:

- successful establishment of natural enemies
- numbers of natural enemies needed for establishment
- site conditions required for establishing natural enemy populations
- interactions among the three exotic natural enemies and native natural enemies
- natural enemy dispersal rates
- impacts on EAB populations and ash survival or recovery
- effects on non-target species

At the conclusion of the first five years of the EAB biological control program, scientists will evaluate which natural enemies are most suitable for long-term mass production and area-wide release.

With oversight from APHIS and the Forest Service, the laboratory will be responsible for rearing these three natural enemies for scheduled releases. Release sites will be determined by APHIS and the Forest Service in consultation with state partners. The releases will depend upon program needs, regulatory approval, and production capabilities. The challenges of rearing these natural enemies will limit their availability for release until the laboratory is fully operational.

Contact: Ken Bloem, Biological Control Coordinator, 919-855-7407
email: Kenneth.Bloem@aphis.usda.gov

Initial releases and post-release monitoring, including impacts on EAB and non-target wood-boring beetles and spread and establishment of each parasitoid species, will be conducted. The Environmental Assessment for this proposed release can be found at the following web site:

http://www.aphis.usda.gov/plant_health/ea/downloads/eab-ea4-07.pdf

Chemical Control

At this time available chemical treatments are not effective for large scale implementation. Therefore, this emergency program can not

recommend chemical control on a large scale. However, depending on beetle population densities, recent research suggests individual trees may be effectively treated (Cappaert et al. 2006). Consult your county or university extension agent for information on approved treatments for your specific area.

If treatments selected or proposed are not in conformance with current pesticide labels, an emergency exemption can be requested and obtained under Section 18, or 24(c), special local need (SLH), of FIFRA, as amended.

Management Records

Program personnel maintain records and maps noting the locations of all detections, the number and type of management treatments, and the materials used in each treated area.

Monitoring

Program personnel implement an effective monitoring program to evaluate program efforts, pesticide use, and environmental impact, including any concerns of the agency, the cooperators, as well as provide data for assessment of application method and the public.

The monitoring program must be a combined effort between the state in which the emergency program is being conducted and PPQ. Specific tasks must be coordinated for monitoring activities.

- Overview** Environmental Services (ES) is a unit of APHIS' Policy and Program Development Staff (PPD). ES manages the preparation of environmental documentation, such as environmental impact statements and environmental assessments, to aid in program operational decisions. ES also coordinates pesticide registration and approvals for APHIS pest control and eradication programs, ensuring that registrations and approvals meet program use needs and conform to pesticide use requirements. Contacts and informational websites are listed in the Resources Section of this document.
- Disclaimer** All uses of pesticides must be registered or approved by appropriate Federal, State, and/or Tribal agencies before they can be applied. The information provided on pesticide labels may not reflect all of the actual information, including precautions and instructions for use, which you are required to follow in your specific State or locality. It is the responsibility of persons intending to use a pesticide to read and abide by the label, including labeling that has been approved for the particular State or locality in which the chemical is to be used, and to comply with all Federal, State, Tribal, and local laws and regulations relating to the use of the pesticide. APHIS program staffs are responsible for their compliance with applicable environmental regulations.
- Protected Species** To ensure that protected species are not impacted negatively during survey and control activities, contact the Emerald Ash Borer (EAB) Program environmental monitor.
- To date, program activities have significantly interfaced with several protected species. Specific protocols have been implemented to mitigate negative impacts on the Indiana gray bat, the bald eagle, the copperbelly water snake, and other species in consultation with Fish and Wildlife Services.
- For further details, see the biological assessment and contact the EAB program environmental monitor.
- Environmental Assessment** All program control activities require review by Headquarters Environmental Services staff before any work may begin. Control activities include eradication and containment actions that require cutting and/or destruction of trees. An environmental assessment is mandatory before APHIS supported control or containment activities may begin.

PUBLIC OUTREACH

Introduction

Education and outreach plays a key role in communicating the operational objectives of the EAB Program; detection, control and eradication. Informed and supportive targeted audiences (industry stakeholders, congressional constituents, special interest groups and the public in general) can serve as advocates as well as active participants in the Cooperative Emerald Ash Borer Program.

It is never too early to begin the education and outreach process. To facilitate the process, the EAB Program has many generic outreach materials that are available and free of charge. **To prevent duplication of efforts and to ensure consistency, contact the EAB program's Legislative and Public Affairs (LPA) specialist to review existing outreach materials. Furthermore all new communication tools (publications, videos, posters, news releases, etc) where the USDA is mentioned, must be reviewed by the LPA program specialists prior to publication.**

General Outreach Objectives

1. Coordinate outreach efforts among cooperators to ensure the program has a consistent message.
 - A. Establish a small core committee, to manage and direct program communication; membership should include state, and federal partners, cooperative extension and other local partners deemed relevant.
 - Identify roles and responsibility for individuals and as a whole
 - Identify policies and procedures for releasing information to public and stakeholders
 - Address financial responsibilities
 - Develop a two-way reporting mechanism with Cooperative Management Staff
 - Establish a Communications Advisory Committee and identify roles and responsibilities. Membership could include industry groups such as professional landscapers and arborists, lumber and wood industry, nursery owners, environmental organizers, and other economically impacted groups. This group will be an invaluable network for the dissemination of messages and information.
2. Develop outreach materials to meet various program needs and reach various audiences. Outreach personnel will work with EAB program managers to identify areas or activities where

outreach materials are needed and do not currently exist.

Priorities will be as follows:

- Identify target audiences and leadership
 - Identify key messages for all program initiatives; survey, public meetings, tree removal and other control activities, etc.
 - Identify key messages to support regulatory activities: “Don’t move firewood”, examine your trees, know federal and state regulations, etc.
3. Deliver outreach materials through a variety of outlets to ensure widest exposure.
- Create a marketing mix using mainstream/alternative/grassroots media to reach targeted audience. (television, radio, outdoor, newspaper, internet, industry publications, civic groups, newsletters, etc.)
 - Reach out to specialized target audiences through their industry newsletters, web site links, and association meetings. Develop “champions” for the program.
 - Seek out opportunities for communication: country fairs, home and garden shows, regional association meetings, Chamber of Commerce events, etc.
 - Establish a speakers’ bureau and create canned power point presentations.

General Outreach Activities and Initiatives

Some of the common activities that might be expected in the outreach portion of an EAB program include:

1. Maintain the EAB website to provide access to current information on EAB, quarantines, survey areas, etc.
2. Maintain a toll-free EAB hotline.
3. Catalogue and review existing informational materials to prevent duplication of effort and ensure consistency.
4. Develop public service announcements and arrange for broadcast on radio and/or television. Utilize a spokesperson with name recognition, if possible.
5. Keep the media informed regarding program activities.
6. Keep local officials, local government, community leaders informed about the program
7. Craft easy to read letters regarding time, date, location, and purpose of public meetings and execute mailing
 - Use tax rolls for names and addresses (Note: tax rolls apply to owners not necessarily residents.)
 - Allow substantial lead time.
 - In resort areas, allow for absentee homeowner issues.
8. Arrange, moderate, and provide presentations and support at

- public meetings
9. Periodically meet with program staff for program feedback, problems, concerns, etc.
 10. Create specialized communication vehicles when needed (magnets, tattoos, stickers, etc.) to support EAB awareness
 11. Continually refine and develop communication vehicles (brochures, posters, newsletters, etc.) to ensure accuracy and current program information.
 12. Develop and arrange for publication of news releases for mainstream and alternative media
 13. Craft (easy to read) letters regarding invasive program activities (survey, tree marking, eradication, etc.) and execute mailings.

Outreach Material There are generic program materials to assist in public education. To prevent duplication of effort and to ensure consistency, before implementing outreach activities contact the EAB LPA specialist to review existing outreach materials.

Telephone Hotline The toll-free telephone EAB hotline is 1-866-322-4512. The hotline should be staffed by trained and knowledgeable personnel who can answer questions about the EAB program and direct callers to appropriate personnel for more in depth questions. Statistical information, such as the number and nature of calls, is reported to outreach personnel.

Web Site www.emeraldashborer.info is the national website developed by the Cooperative EAB Program and funded by the Forest Service as a source and link to federal and state information. It contains current program information including: quarantine information, maps, EAB signs and symptoms, ash tree identification, treatment options, prevention, tree removal and replacement and on-going research.

Additionally, general public may email the program at EmeraldashborerInfo@aphis.usda.gov.

Public Meetings or Informational Open Houses Public meetings or informational open houses will take place when deemed necessary and appropriate in particular when control efforts such as tree removal or pesticide treatments impact a community. These meetings will address public concerns, communicate the program strategy and actions, and secure community support.

Outreach personnel will coordinate scheduling and facilities, ensure that public meetings or informational open houses notifications are posted in appropriate newspapers and other media outlets and that handouts, fact sheets, informational posters, and other outreach materials are readily available at the meeting. Where possible, outreach personnel will make

advance direct mailings to notify residents of the impacted community of the meeting.

Public meetings will be organized as deemed appropriate and will include partner agency participation such as:

1. Political representatives and community leaders who are familiar with local concerns and recognized by the local community.
2. State and Federal program representatives who can respond to questions about EAB, quarantine restrictions, control measures, and its impact.
3. Representatives from cooperating state universities who can answer questions about biology of EAB, its host range, and potential impact in the United States.
4. County, city and local cooperators who can respond to questions about their roles.

Media Relations

The APHIS, PPQ, and LPA staff should be notified as soon as possible after EAB is confirmed and routinely notified of any media requests. All national media calls must be coordinated with APHIS/LPA. One primary media spokesperson should be designated by the cooperator to work with the EAB LPA spokesperson. To avoid conflicting and confusing statements, all outgoing information should be processed through the designated spokesperson. The spokesperson should thoroughly understand particular aspects of the program, such as survey, regulatory, and control activities, as well as the federal and state quarantines. All EAB program spokespersons will develop and maintain close contacts with each other and reporters and community group leaders to provide accurate and consistent information. If no local personnel at the local level exists or they do not have adequate media experience, the EAB LPA specialist should be notified so they can provide experienced media representation to the program.

Literature cited:

- Bauer, L. S., R. A. Haack, D. L. Miller, T. R. Petrice, and H. Liu. 2004. Emerald ash borer life cycle. In: *Emerald ash borer research and technology development meeting*, Ed. V. Mastro and R. Reardon.
- Cappaert, D., D. G. McCullough, T. M. Poland, and N.W. Siegert. 2005. Emerald ash borer in North America: A research and regulatory challenge. *American Entomologist*, 51:152-165.
- Chinese Academy of Science, Institute of Zoology. 1986. *Agrilus marcopoli* Obenberger. Agriculture Insects of China (part I), China Agriculture Press, Beijing, China.
- Francese, J. A., I. Fraser, D. R. Lance, and V. C. Mastro. 2006. Developing survey techniques for emerald ash borer: The role of trap height and design. In: *Emerald ash borer and asian long-horned beetle research and technology development meeting*, Ed. V. Mastro, D. Lance, R. Reardon, and G. Parra.
- Liu, H-P, L.S. Bauer, R-T Gao, T-H Zhao, T.R. Petrice, and R.A. Haack. 2003. Exploratory survey for the emerald ash borer, *Agrilus planipennis* (Coleoptera: Buprestidae), and its natural enemies in China. *Great Lakes Entomologist*. 36:191-204.
- Lyons, D. B. G. C. Jones, and K. Wainio-Keizer. 2004. The biology and phenology of the emerald ash borer. In: *Emerald ash borer research and technology development meeting*, Ed. V. Mastro and R. Reardon.
- McCullough, D. M. and N. W. Siegert. 2006. Using girdled trap trees effectively for emerald ash borer detection, delimitation, and survey. <http://www.emeraldashborer.info/files/handoutforpdf.pdf> Last accessed January 18, 2008.
- McPartlan, D., P. D. Bell, C. Kellogg. 2006. Eradication of emerald ash borer in Michigan, Ohio, and Indiana – Implementation of the strategic plan. January 11, 2006 revision. http://www.aphis.usda.gov/plant_health/ea/downloads/eab-ea4-07.pdf Last accessed January 18, 2008.
- Nomura, S. 2002. *Agrilus planipennis*. Canadian Food Inspection Agency Science Branch. Last accessed November 30, 2004.
- Poland T. M. and D. G. McCullough. 2006. Emerald ash borer: Invasion of the urban forest and the threat to North America's ash resource. *Journal of Forestry*, 118-124.

- Taylor, R. A. J., T. M. Poland, L. S. Bauer, K. N. Windell, and J. L. Kautz. 2006. Emerald ash borer flight estimates revised. In: *Emerald ash borer research and technology development meeting*, Ed. V. Mastro, D. Lance, R. Reardon, and G. Parra.
- Taylor, R. A. J., L. S. Bauer, D. L. Miller, and R. A. Haack. 2004. Emerald ash borer flight potential. In: *Emerald ash borer research and technology development meeting*, Ed. V. Mastro and R. Reardon.
- Timms, L. L., S. M. Smith, and P. de Groot. 2006. Patterns in the within-tree distribution of the emerald ash borer *Agrilus planipennis* (Fairmaire) in young green-ash plantations of south-western Ontario, Canada. *Agricultural and Forest Entomology*, 8:313-321.
- US Forest Service. 2008. Emerald ash borer maps.
<http://www.ncrs.fs.fed.us/4501/eab/maps/> Last accessed: 01/17/08.
- Yang, Z-Q., J.S. Strazanac, Y-X Yao, and X-Y Wang. 2006. A new species of emerald ash borer parasitoid from China belonging to the genus *Tetrastichus* Haliday (Hymenoptera: Eulophidae) parasitizing emerald ash borer from China. *Proceedings of the Entomological Society of America*. 108:550-558.
- Yang, Z-Q, J. S. Strazanac, P. M. Marsh, C. van Achterberg, and W-Y, Choi. 2005. First recorded parasitoid from China of *Agrilus planipennis*: A new species of *Spathius* (Hymenoptera: Braconidae, Doryctinae). *Annals of the Entomological Society of America*. 98(5):636-642.
- Yu, C. 1992. *Agrilus marcopoli* Obenberger (Coleoptera: Buprestidae), pp. 400-401. In: *Forest Insects of China* (2nd edition) Ed. G. Xiao, China Forestry Publishing House, Beijing, China.
- Zhang, Y-Z., D-W Huang, T-H Zhao, H-P Liu, and L.S. Bauer. 2005. Two new egg parasitoids (Hymenoptera: Encyrtidae) of economic importance from China. *Phytoparasitica*. 33:253-260.

Anthropogenic	Human caused
Cambium	The meristematic tissue in woody plants that exists between the wood (xylem) and the inner most bark (phloem)
Delimiting survey	A sampling method to determine extent of an infestation of an exotic species in an area
Destructive sampling	Method of observing signs and symptoms of the presence or absence of a pest by destruction of the living sample unit; <i>i.e.</i> , removal of bark to look for larvae
Detection survey	A sampling technique to determine the presence or absence of a non-native species in an area
Detection tree technique	Determining the presence or absence of a pest through the use of randomly or strategically placed host trees artificially manipulated to attempt attraction of target pest organisms. These trees may be maintained and serviced on a schedule dictated by the goal of the survey
Developmental thresholds	The minimum and/or maximum temperatures that support physiological development of a species
Diapause, Facultative	The cessation of growth and reduction of metabolic activity in a species which occurs seasonally or when environmental conditions are unfavorable
Diapause, Obligatory	A period of quiescence genetically controlled and affecting every individual of every generation within a species regardless of environmental conditions
Dispersal, Active	The spread of an organism by its own method of locomotion (<i>e.g.</i> , walking, flight, etc.)
Dispersal, Passive	The spread of an organism aided by other than its own method of locomotion (<i>e.g.</i> , wind, water, man, etc.)
Ectoparasitoid	A parasitoid that develops inside the host
Endoparasitoid	A parasitoid that develops outside the host and is attached or embedded in host tissue
Epicormic shoots	Fast growing, relatively soft stems arising from the main trunk below the crown or root collar of a dying or stressed tree. Sometimes referred to as “water sprouts” or “suckering”

Exotic species	An organism or pest species not native to nor historically resident in North America, also referred to as alien, non-native, or invasive species
Generally infested area	All areas within a 100 mile radius extending out from the peripheral positive EAB finds
Generation	One complete life cycle
Growing degree day	A measure of the number of thermal units (degrees) that accumulate above a specified base temperature over a 24 hour period
Host	A species that provides food, shelter, or reproductive requirements for another organism
Leading edge	The outer boundary defined by the 100 mile radius emanating from the peripheral EAB positive finds
LPA, APHIS, USDA	Legislative and Public Affairs, Animal and Plant Health Inspection Service, United States Department of Agriculture
Monophagous	Feeding on only one type of food
Multivoltine	Producing more than one generation per year
Obscure-aeneous	Dark coppery color
Parasitoid	An organism that lives on or in another organism, usually referred to as its host, and from which it obtains nourishment
Phloem	Nutrient conducting tissue of the inner bark
Phototactic	Movement of an organism toward or away from a light source
PPQ, APHIS, USDA	Plant Protection and Quarantine, Animal and Plant Health Inspection Service, United States Department of Agriculture
Regulated articles	All known or suspected hosts of a confirmed infestation of a non-native species, including soil and any other suspected product or article
Semio-chemicals	Chemicals emitted by plants, animals and other organisms and synthetic analogues of such substances, that evoke a behavioral or physiological response in individuals of the same or other species
Thanatosis	Feigning death in order to avoid predation
Thermotactic	Movement of an organism toward or away from a heat source

Visual survey	Simple examination of areas for eggs, larvae, pupae, or other evidence to determine if a particular insect species is present
Xylem	Water conducting tissue that comprises the bulk of most woody plants; wood

Agrilus planipennis Fairmaire Screening Aid

J. E. Zablony, USDA APHIS PPQ



Figure 1. *Agrilus planipennis* Fairmaire.

Members of the genus *Agrilus* are challenging to identify due to structural coloration and subtle morphological differences between species. Furthermore, the presence of newly discovered exotic *Agrilus* species in the Midwest and Ontario complicates identification issues and demands a renewed interest in applied taxonomy of *Agrilus* beetles.

The emerald ash borer (EAB) is an invasive buprestid beetle native to Northeast China, Korea, Japan, and Russia (Figure 1). In Michigan, and Ontario, this pest is established and has devastated stands of native ash trees. The following characteristics can be used for discriminating EAB from other native *Agrilus* species:

- No patches of pubescence
- Pronotum copper/green
- Elytra and abdominal sternites emerald green

- Abdominal tergites purplish copper in color
- Length 13 mm
- Emarginate pygidial spine (Figure 2).
- **EXOTIC**



Figure 2. Pygidium of *A. planipennis*.

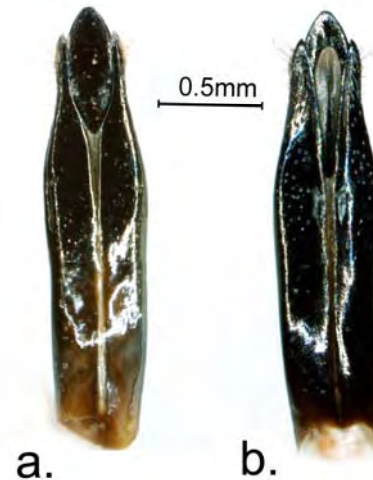


Figure 3. Aedeagus of *A. planipennis* (a. tergal, b sternal views).

Some commonly intercepted native and exotic species are illustrated and briefly described on the following pages.

Agrilus bilineatus (Weber):



Figure 4. *Agrilus bilineatus* (Weber)

- Pubescent line on pronotum extending down each elytron.
- Bronze-black to dark blue.
- Length 11 mm
- Host *Quercus* spp.

Agrilus cyanescens Ratzeburg



Figure 5 *Agrilus cyanescens* Ratzeburg

- No patches of pubescence.
- Metallic blue in color, darker below.
- Length 8 mm
- Host: *Lonicera* spp.
- **EXOTIC**

Agrilus anxius (Weber)



Figure 6. *Agrilus anxius* (Weber)

- No patches of pubescence.
- Bronze-black
- Length 12-13 mm
- Host: *Betula* spp. *Agrilus vittaticollis* (Randall)



Figure 7. *Agrilus vittaticollis* (Randall)

- Pubescent line on pronotum.
- Pronotum copper colored with dark elytra, darker below with violet highlights.
- Length 10-12mm
- Hosts: *Crataegus*, *Malus*, *Amelanchier* spp.

Agrilus obsoletoguttatus



Gory

Figure 8. *Agrilus obsoletoguttatus* Gory

- Pubescent spots on elytra.
- Copper color with violet elytral apices, darker below.
- Length 9-10 mm
- Hosts: Hardwood spp.

Agrilus masculinus



Horn

Figure 9. *Agrilus masculinus* Horn

- No distinct patches of pubescence
- Bronze-black, green face on males
- Length 6-7 mm
- Hindleg tarsi longer than tibia
- Host: *Acer negundo*

In addition to *Agrilus planipennis*, *A. subcinctus* Gory is the only other *Agrilus* species known to occur on *Fraxinus* in the Midwest. *A. subcinctus* differs behaviorally from *A. planipennis* in that it is a twig borer and prefers smaller branches for oviposition. In the field, *A. subcinctus* can be sweep-netted from ash leaves. *A. subcinctus* is

small in size (>4.0 mm) and features a distinct subbasal and subapical spots of scale-like pubescence on the elytra (Figure 10).



Figure 10. *Agrilus subcinctus* Gory

All of these *Agrilus* are often found on sticky and in funnel trap samples. With close to 50 *Agrilus* species known from the Midwest, I expect other species to be added to this preliminary guide in the near future.

FEDERAL COMPLIANCE AGREEMENT SAMPLE TEMPLATES

The following link provides compliance agreement templates issued for regulatory activities as part of the EAB program in each state. Please see the templates on the web site for guidance on what is included in each compliance agreement.

http://www.aphis.usda.gov/plant_health/plant_pest_info/emerald_ash_b/regulatory.shtml

CONTACTSUSDA APHIS PPQ**EAB Hotline: 1-866-322-4512 (Toll Free)**

Paul Chaloux, EAB National Program Manager

Phone: 301-734-0917

e-mail: Paul.Chaloux@aphis.usda.gov

Philip Bell, EAB Program Director, Raleigh, NC

Phone: 919-855-7312

e-mail: Philip.D.Bell@aphis.usda.gov

Craig Kellogg, EAB Program Coordinator, Brighton, MI

Phone: 810-844-2703

e-mail: Craig.Kellogg@aphis.usda.gov

Elizabeth W. Pentico, Supervisory PPQO, Brighton, MI

Phone: 810-844-2737

e-mail: Elizabeth.W.Pentico@aphis.usda.gov

Doug Bopp, Geographer, Brighton MI

Phone: 810-844-2727

e-mail: Douglas.A.Bopp@aphis.usda.gov

Ken Witt, Environmental Monitor, Brighton, MI

Phone: 810-8442716

e-mail: Kenneth.A.Witt@aphis.usda.gov

Sharon Lucik, Legislative and Public Affairs Specialist, Brighton, MI

Phone: 810-844-2713

e-mail Sharon.E.Lucik@aphis.usda.gov

James H. Buck, Ph.D., Program Analyst, Brighton, MI

Phone: 810-844-2733

e-mail: James.H.Buck@aphis.usda.gov

Identification Authority – New State or County Finds

Dr. James Zablotny, USDA APHIS PPQ, Area Identifier

11200 Metro Airport Dr., ste. 140

Romulus, MI 48174

Phone: 734-942-9005

e-mail: James.E.Zablotny@aphis.usda.gov



United States Department of Agriculture
Animal and Plant Health Inspection Service
Plant Protection and Quarantine

Cooperative Emerald Ash Borer Project



Information Packet

	<u>Toll Free Hotline</u>	<u>Website</u>
Illinois	800-641-3934	www.illinoiseab.com/
Indiana	866-663-9684	www.entm.purdue.edu/eab
Maryland	800-342-2507	www.mda.state.md.us/plants-pests/eab/
Michigan	866-325-0023	www.emeraldashborer.info
Ohio	888-644-6322	www.ohioagriculture.gov/eab
Pennsylvania	866-253-7189	http://www.dcnr.state.pa.us/forestry/ fpm_invasives_EAB.aspx
West Virginia	866-322-4512	http://www.wvforestry.com/eab.cfm
Wisconsin	800-462-2803	dnr.wi.gov/org/land/Forestry/FH/Ash/
USDA	866-322-4512	www.aphis.usda.gov/ppq

For additional information you may also send email to the Cooperative Emerald Ash Borer Project at: EmeraldAshBorerInfo@aphis.usda.gov



Distinguishing Ash from other Common Trees

Diane Brown-Rytlewski and Rebecca Thompson

Michigan State University IPM Program

Identifying ash trees

Due to the recent discovery of the emerald ash borer (EAB) in Michigan, it is important to be able to recognize and identify ash trees. To date, emerald ash borer has only

been found on ash trees (see page 4). Not sure if your tree is an ash? This simple key is intended to help you distinguish between some common deciduous landscape trees frequently confused with ash, including: elm, boxelder, mountainash, walnut and hickory.

Using the identification key

Begin at number 1 on the key and choose (a) or (b). Then proceed to the number listed in italics at the end of your choice. This number will give you a new set of choices. Continue this way through the key. We have listed enough characteristics to help you determine whether or not your tree is an ash. If it doesn't match the characteristics in the key, relax; it most likely isn't an ash. If you don't want to use the

key, tree ID photos are on pages 2-4.

If you are still curious about what kind of trees you have, consult Extension Bulletin E-2332, "Identifying Trees of Michigan," or a good field guide such as: "The Tree Identification Book," by George W.D. Symonds; "Tree Finder: A Manual for the Identification of Trees by Their Leaves," by May T. Watts; or "A Field Guide to Trees and Shrubs" by George A. Petrides. There are many other good guides available; these are mentioned only as examples.

Identification key

1. a) Branches alternate (Fig. 1) – *go to 2*
b) Branches opposite (Fig. 2) – *go to 4*
2. a) Simple leaves, with irregular leaf base and toothed edge (Fig. 3). See **elm**, page 2.
b) Compound leaves (Fig. 4), with 9 to 15 leaflets, finely toothed around edge of leaf – *go to 3*
c) Compound leaves, 5 to 7 leaflets – *go to 3c*
3. a) Cut open twig lengthwise.
Chambered pith (Fig. 6). See **black walnut**, page 3.
b) If pith is not chambered, but has white flowers in May, orange or red berries in fall. See **mountainash**, page 3.
c) If pith is not chambered, but has three leaflets at end of leaf larger than the rest. See **hickory**, page 2.
4. a) Compound leaves, 5 to 9 leaflets, smooth or finely toothed around outer edge. See **ash**, page 4.
b) Compound leaves, 3 to 5 leaflets, few coarse teeth or none, end leaflet pointed (Fig. 5). See **boxelder**, page 4.



Fig. 1- Alternate branching

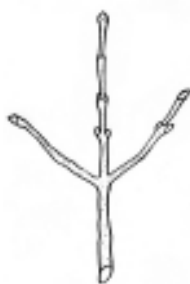


Fig. 2- Opposite branching



Fig. 3- Simple leaf (American elm)



Fig. 4- Compound leaf, 7 leaflets (White ash)



Fig. 5- Compound leaf, 3 leaflets (Boxelder)



Fig. 6- Chambered pith (Black walnut)

Line drawings: Steven Brown

Definitions

- Alternate – leaves/branches that are staggered or not directly across from each other, Fig 1.
- Opposite – leaves/branches that are directly across from each other, Fig. 2.
- Simple – a single leaf blade joined by its stalk to a woody stem, Fig 3.
- Compound – a leaf with more than one leaflet. All leaflets attached to a single leafstem, Fig. 4-5.

Appendix D

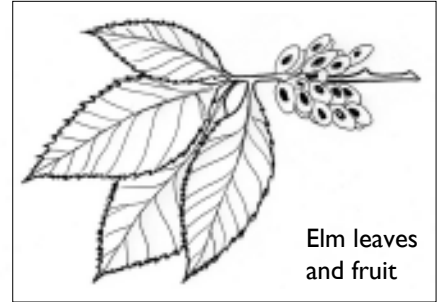
Elm, Ulmus spp.

Branches and buds are alternate and leaf bases are unequal. The leaves are simple, serrate (toothed) and 3 to 6 inches long and 1 to 3 inches wide (American elm) or 3/4 to 3 inches long and 1/3 to 1 inch wide (Siberian elm). The fruit is a winged seed.

Sandy Perry



Sandy Perry



Elm leaves and fruit



Unequal leaf base

Mary Wilson



Alternate branching

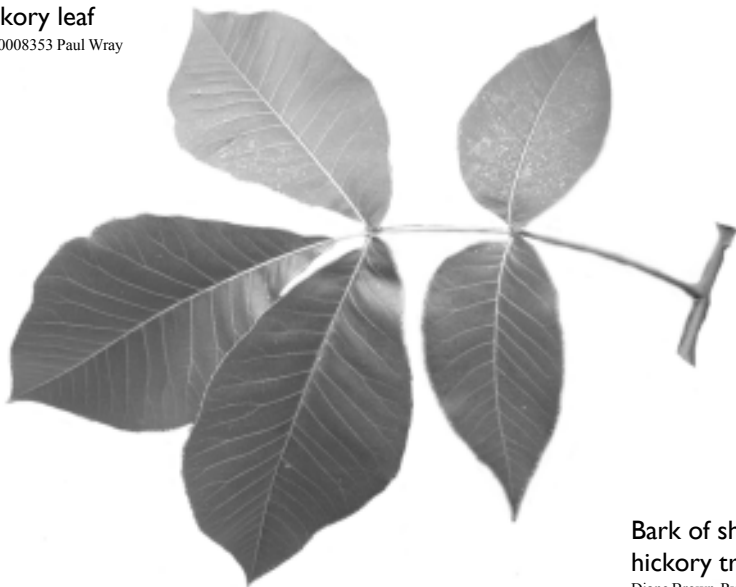
Left: American elm has a vase-shaped growth habit. Right: Siberian elms are fast-growing, brittle trees that break easily. Other elms will have similar leaves and seeds, although leaf size and growth habit will vary.

Hickory, Carya spp.

Shagbark hickory has distinctive bark – long, loose, shaggy strips. Leaves are compound, 8 to 14 inches long with 5 to 7 leaflets. The three terminal leaflets are larger than the other leaflets. Other similar species (not shown) include bittersweet, pignut and mockernut, which have similar leaves and fruits although leaf size will vary. They do not have distinctive shaggy bark. These trees are seldom planted in landscapes, but are native, and may be found growing in woods. Fruits are hard-shelled light brown nuts, in a green husk that splits into four parts.

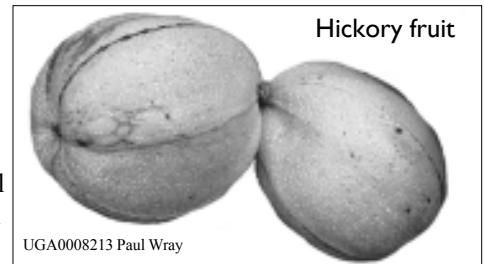
Hickory leaf

UGA0008353 Paul Wray



Bark of shagbark hickory tree

Diane Brown-Rytlewski



Hickory fruit

UGA0008213 Paul Wray



Appendix D



Black walnut fruit

UGA0008279 Paul Wray

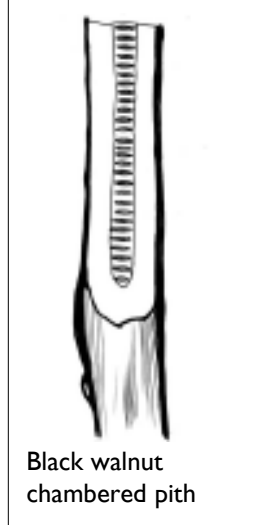


Black walnut leaf

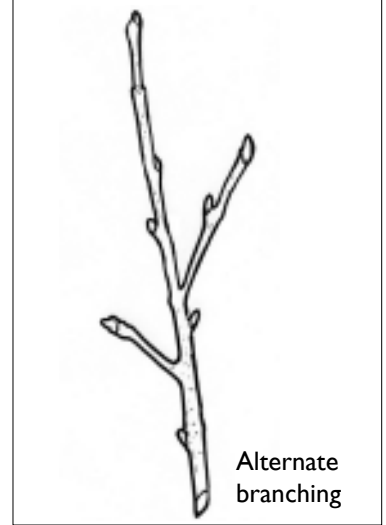
UGA0008448 Paul Wray

Black walnut, Juglans nigra

Branches and buds are alternate. Leaves are compound, 15 to 24 inches long, with 9 to 15 leaflets/leaf. Crushed leaflets and stems have a distinct odor – similar to turpentine. Twigs, split lengthwise, have chambered pith. Fruit is a large dark brown nut inside a green husk.



Black walnut chambered pith



Alternate branching

Mountainash — alternate branching

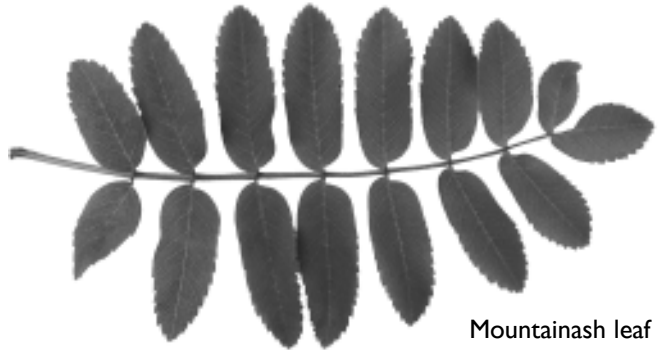
Diane Brown-Rytlewski



European mountainash, Sorbus aucuparia

Sorbus aucuparia

Leaves are compound, 5 to 9 inches long with 9 to 15 leaflets per leaf. Leaflets are a toothed, rounded oval shape. Flowers are five-petaled, white and similar to cherry or apple blossoms but in clusters. Fruits are fleshy, red-orange berries in clusters – they are found in the fall.



Mountainash leaf

Diane Brown-Rytlewski

Mountainash flowers

Diane Brown-Rytlewski

Appendix D

Ash, *Fraxinus* spp.

Branches and buds are opposite with a single bud at the end of the branch (terminal bud). Twigs are gray to brown and do not have a waxy coating. Leaves are compound, 8 to 12 inches long, 5 to 9 leaflets/leaf. Leaves may be finely toothed or have smooth edges. The most common ash trees planted in the landscape are **white ash** (*Fraxinus americana*) and **green ash** (*Fraxinus pennsylvanica*). Other native ash trees less commonly found include **black ash** (*Fraxinus nigra*) and

blue ash (*Fraxinus quadrangulata*) (not shown). **Black ash** has 7 to 11 leaflets and is found in wet woods; **blue ash** has 7 to 11 leaflets and distinctive 4-angled corky wings on the stem. **White ash** buds are paired with a leaf scar beneath the bud that looks like the letter “C” turned on its side. **Green ash** buds are paired with a leaf scar beneath the bud that looks like the letter “D” turned on its side (like a smile). Individual fruits are shaped like single wings and occur in clusters; many ash cultivars are seedless.



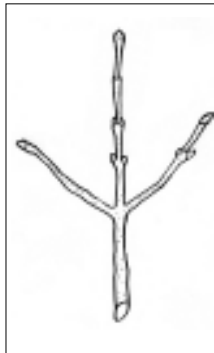
UGA0008289 Paul Wray

Green ash leaf



Diane Brown-Rytlewski

White ash leaf



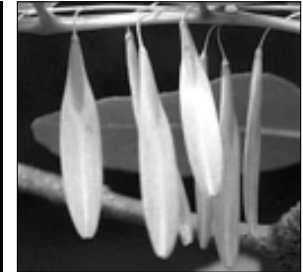
Opposite branching

Dave Cappaert



Left: green ash leaf scar. Right: white ash leaf scar.

UGA0008169 Paul Wray

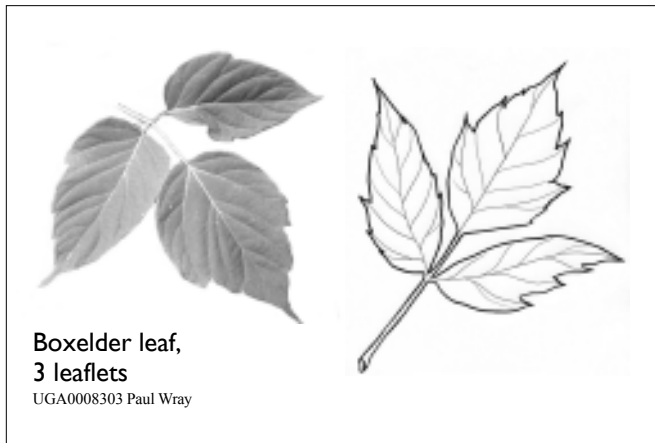


Ash seeds

Boxelder, *Acer negundo*

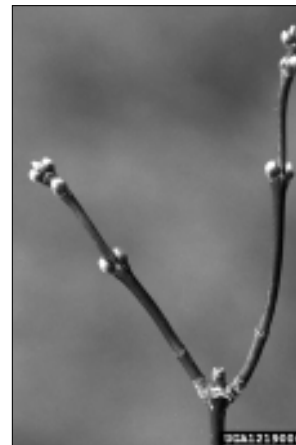
Boxelder is sometimes called ash-leaved maple. The twigs and buds are opposite; with a single bud on the end of the twig (terminal bud). Twigs are green to purplish brown, and often have a waxy white coating that can be rubbed off the

stem. Leaf scars beneath the buds are narrow, and join in a point. Leaves are compound, 4 to 10 inches long, with 3 to 5 leaflets/leaf. Leaves may have a few coarse teeth, or none. The end leaflet is sharply pointed. Fruit is a paired winged seed, occurring in clusters.



Boxelder leaf,
3 leaflets

UGA0008303 Paul Wray



Boxelder branches

UGA1219006 Bill Cook



Boxelder fruit

UGA1219003 Bill Cook

Photo credits:

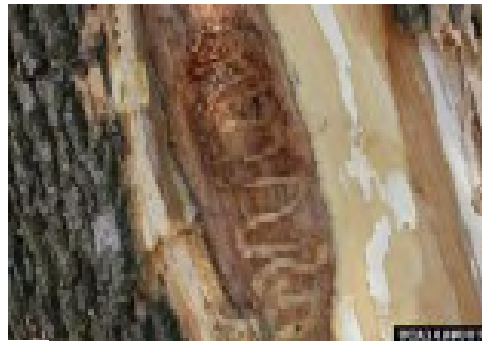
Bill Cook, Michigan State University, www.forestryimages.org/

Paul Wray, Iowa State University, www.forestryimages.org/

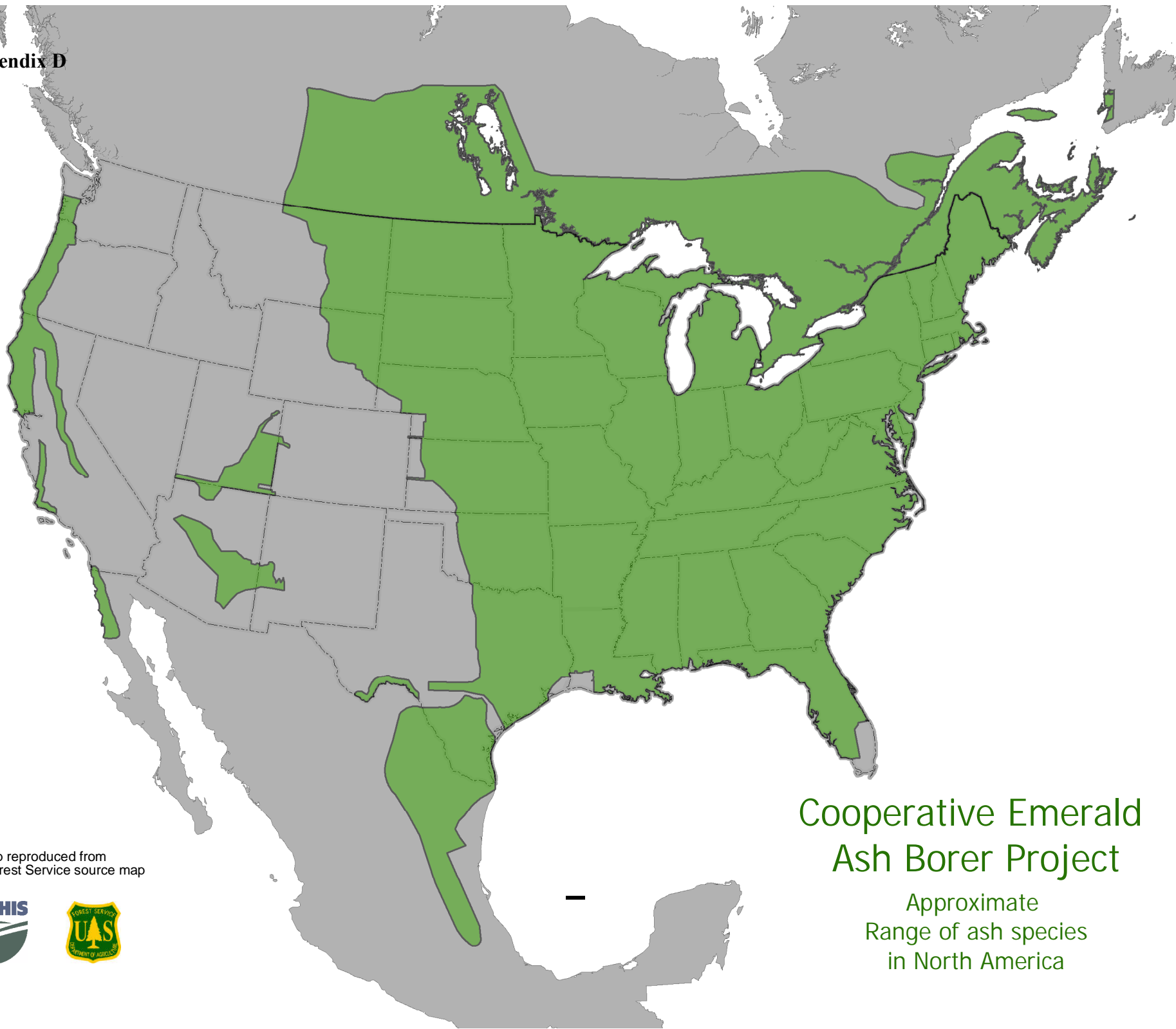
MSU is an Affirmative-Action Equal-Opportunity Institution. MSU Extension programs and materials are open to all without regard to race, color, national origin, gender, religion, age, disability, political beliefs, sexual orientation, marital status, or family status. Issued in furtherance of Extension work in agriculture and home economics, acts of May 8 and June 20, 1914, in cooperation with the US Dept. of Agriculture. Margaret A. Bethel, Extension director, Michigan State University, E. Lansing, MI 48824.

The information is for educational purposes only. Reference to commercial products or trade names does not imply endorsement or bias against those not mentioned. Reprinting cannot be used to endorse or advertise a commercial product or company.

Emerald Ash Borer Symptoms



Appendix D



Cooperative Emerald Ash Borer Project

Approximate
Range of ash species
in North America

Map reproduced from
USDA Forest Service source map



Appendix D

Inspector Name: _____ Date: _____

Regulatory Contact

Concern or Business Name: _____

Contact Name: _____

Street Address: _____ City: _____

State: _____ Zip Code _____

County: _____

GPS Lat _____ Long _____

Phone: _____

Concern Type (circle up to three)

Nursery / Garden Center / Firewood Dealer / Public Campground / Private
Campground / Milling & Manufacturing / Landscaper / Research / Municipality /
Tree Removal Service / Landscaper / Logging Company / Misc. / Pallets / Pallet
Stock / Mulch

Aware of EAB Quarantine Y or N If yes,
how? _____

Interstate Movement Y or N

What/Commodity?

Frequency of shipments?

Quantity per shipment?

Final Destination of shipments?

From area near EAB positives?

Shipping Documents Available?

***Signature below confirms representative(s) of the Cooperative Emerald
Ash Borer Project contacted the signatory individual and gave them an
information packet about Emerald Ash Borer.***

Printed Name: _____

Signature: _____

Date: _____

Appendix D

Survey of Ash

Ash Product	Present? Y or N	Origin	Quantity	Inspected? Y or N	How long has the material been on site?
Firewood					
Nursery Stock					
Estab. Ash					
Ash Chips/Mulch					
Saw Logs					
Other					

Campground Survey

	Ash firewood Present? Y or N	% OH plates	% MI plates	% IN plates	Local Firewood Available	Permanent Campsites Present
Private Campground						
Public Campground						

EAB symptoms or specimens present Y or N,

If yes record ash product and X all indicators that apply.

Ash Product: _____

Crown Dieback	Life Stage	D-shaped holes	Bark splits	Epicormic shoots	Serpentine Gallery	Die-Back	Woodpecker Damage

Remarks:

Cooperative Emerald Ash Borer Project

Appendix D






Quarantined Zones

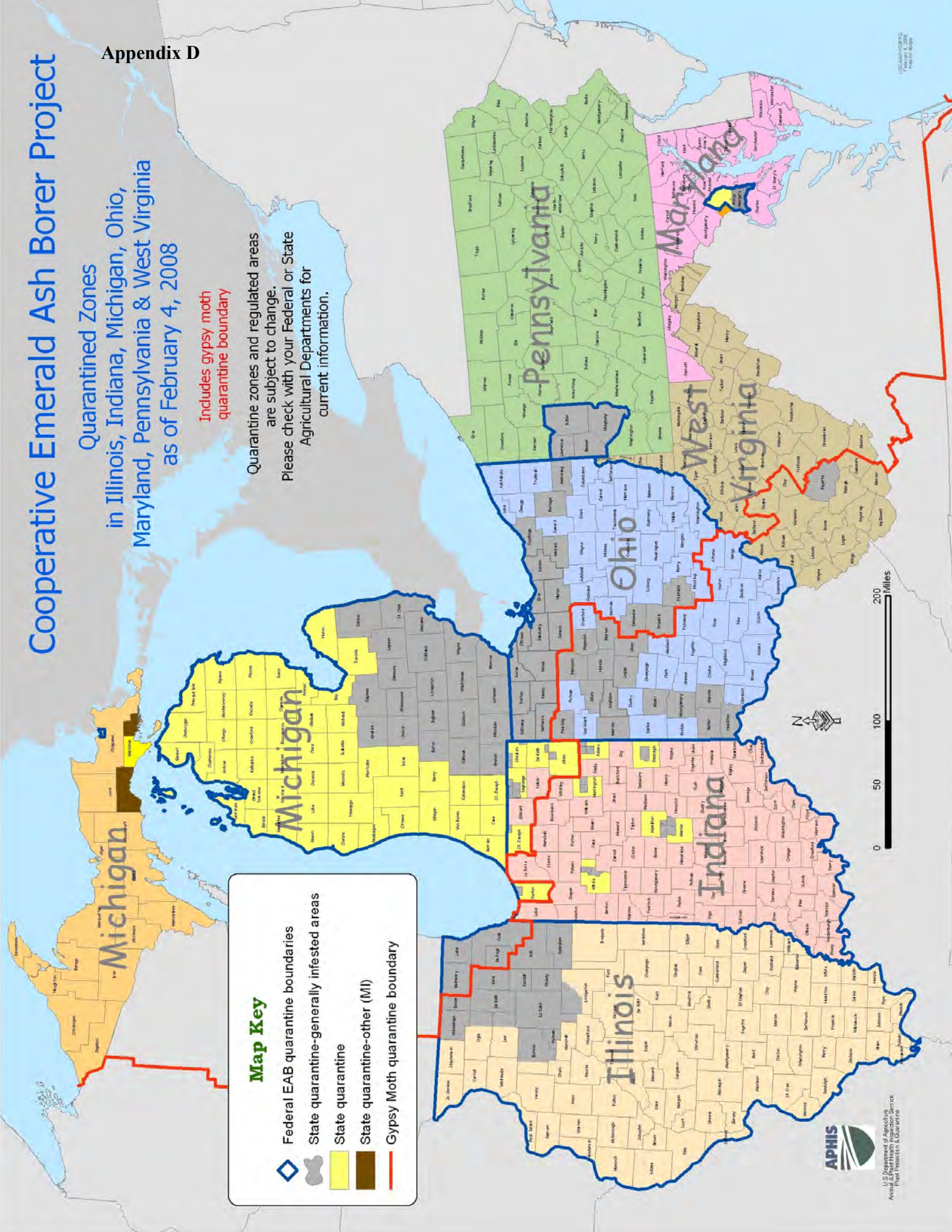
in Illinois, Indiana, Michigan, Ohio,
Maryland, Pennsylvania & West Virginia
as of February 4, 2008

Includes gypsy moth
quarantine boundary

Quarantine zones and regulated areas
are subject to change.
Please check with your Federal or State
Agricultural Departments for
current information.

Map Key

-  Federal EAB quarantine boundaries
-  State quarantine-generally infested areas
-  State quarantine
-  State quarantine-other (MI)
-  Gypsy Moth quarantine boundary



1/28/08/08/08/08
February 4, 2008
Final for scope

Guidelines for Use in Preparing to do a Firewood Operation

The following items may be useful to consider when planning to do a firewood operation roadside stop.

1. Cooperators

Define the cooperators to participate in operation and meet with them well in advance of the operations. Clearly define each others roles and authorities especially as it applies to stops, searches, and what to do with individuals who do not cooperate. Set up a contact point person for each cooperator in the operation. Cooperators to consider are:

- a. State Dept. of Agriculture- This is the primary cooperator and operations should be staffed with both federal and state regulators.
- b. Law Enforcement – Law enforcement cooperators typically include state police for major routes, sheriffs for secondary roads, and municipal police within city/town limits. Motor carrier enforcement is not typically involved in firewood operations; they are typically cooperators monitoring log movement. Law enforcement generally provides a squad car parked with flashing lights just prior to the stop and a uniformed officer for support. We have found that this is a beneficial arrangement as law enforcement often will find violations of their own, or it is OT for the officer, or they officers themselves become engaged and participate in the outreach. A benefit for State Departments of Agriculture you may discuss using the salary/costs of the officer as part of cost sharing towards federal dollars match.
- c. State DOT- DOT should be contacted to discuss the operation site and provide traffic control equipment to maximize public and officer safety. Equipment usually includes a flashing marquee about ½ mile before the stop, cones and barrels.
- d. Public Information Staff – Publicizing these events is critical to continued public education and outreach, but when and how is pretty much state driven. In some states they must publicize a roadside stop prior to conducting it. In those states a generic notification has been sent out saying firewood operations would occur over the weekend, but not detailing exactly when or where. Several operations have also invited media to the event itself where they are allowed to shoot footage and usually the PIO meets them there to answer questions and provide outreach. One operation was even published in USA Today.
- e. APHIS-IES- It is beneficial to involve IES in the early planning. They may opt to be present for the operation or not, but as they will be receiving the Notifications of Violation, they should participate in set-up.

- f. Native Americans - Any state conducting operations with federally recognized Native American groups may want to outreach to them to let them know and have a voice as appropriate.
- g. Misc. – Other state agencies may want to participate such as the DNR. Incorporate these groups as you see fit. If the operations is done close to a state line, the adjoining state should be notified.

2. Site Selection

Careful attention should be made to site selection addressing all of the following factors at a minimum.

- a. Potential Firewood Movement – Evaluate the route on which the operation is proposed. Does the route provide fairly direct access to recreational areas where camping will occur or is it an artery into the state for vacationers? Will travelers likely be coming from an infested/regulated area?
- b. Traffic Volume – At this point, no mandatory stop operations have been conducted on interstates for valid reasons. Volume of traffic is high, vehicle speeds are high, and stop logistics untenable for law enforcement. The best options thus far have come from secondary US routes and state routes that are two lane roads. It is extremely useful to place the stop at an area where the road widens into 3 lanes for a short time. Officers can generally work safely in the middle lane. On these secondary routes traffic volume is sufficient to make operations effective but, not such a great volume that officers are creating back-ups. One consideration we have agreed to with law enforcement is to stop operations if the back-up becomes too great and allow a period of free movement.
- c. Physical Conditions – The site must provide regulators the safe ability to stop cars safely, provide an inspection area, route vehicles back into traffic, and provide staff parking. Examples of sites used have included: two lane road near church with church's permission to use parking lot for inspections and church bathroom for officers; three lane route with temporary storage yard permission to use parking lot for inspections, gas stations nearby; two lane route with extensive shoulder/parking area in front of residence/business with owner permission; two lane route with historic marker pullout for inspection; town street with Elks Lodge permission to use parking lot for inspection and lodge for bathrooms (although they were not to happy with us when they realized the town cop would be with us all day watching who came in to drink and how long they were there).
- d. Amenities – Operations vary in length from 6 to 12 hours typically and needs of the regulatory staff must be considered. Restroom facilities must be provided within a reasonable distance. If no eating facilities are near-by staff needs to be informed so they can

prepare for that. The program has several shade tents and usually sets one up to give officers a break from the sun and/or rain. It can be very hot standing on the tarmac in the sun. The program has provided ice chests and management has provided bottled water and ice (from our own pockets-not govt. approved). Chairs and a folding table are also a real benefit to allow people breaks.

- e. Firewood Disposal – This is a critical component. If the operations are conducted outside a quarantined area (usual circumstance) then the material collected must be safeguarded or treated immediately. To date the program has utilized enclosed vehicles to store wood and transport it back into the quarantined area or burned it expeditiously on site or near-by. Another option would be to have a chipper on site and chip the material to less than 1" in 2 dimensions. Some state run operations have routinely allowed the individuals to burn the material within 48 hours. The EAB program does not support that disposition option.

3. **Operation Date**

The most effective dates for operations are those that precede some event in the area that draws the camping public. This can be as obvious as traditional holiday weekends including Memorial Day, Labor Day, and 4th of July. There are many other events that may occur in your area that draw large crowds that camp. Some we have run across are:

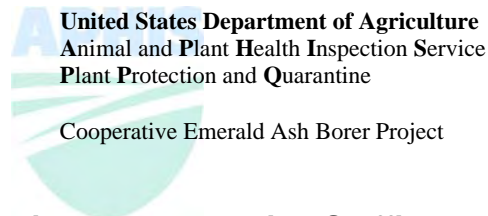
- Bluegrass music festivals
- NASCAR races
- Coon dog trials
- Native American pow-wows
- Fall color tourism
- Hunting season
- Halloween (a large camping draw in Ohio)
- Horse camping events
- Fishing tournaments
- Morel season
- College rivalry sporting events

4. **Equipment**

What follows is a list of equipment the program has found useful at operations.

- a. Shade tent
- b. Folding table
- c. Folding chairs
- d. Orange pylons
- e. Cooler

- f. Enclosed vehicle for firewood transportation
- g. Operations Box (OpsBox) – plastic tubs w/lid we keep ready to go
 - a. Work gloves
 - b. Vials with alcohol & larval forceps
 - c. Chisels
 - d. Outreach material – pamphlets, tattoos, EAB ID guides, etc.
 - e. Accordion folders with: operation protocol, current quarantine maps, current quarantine language, EANs, PPQ 518s, maps to closest hospital/urgent care facility, PPQ 391s, directions to disposal site if applicable, lists of participants and contact numbers, operation log and survey forms
 - f. Hand held STOP/SLOW signs
 - g. Safety vests – reflective mesh with pocket
 - h. Orange flags
 - i. First aid kit
 - j. Flashlight
 - k. Digital camera



**Firewood Roadside Stop Operation
General Staff Duties**

Firewood Operation Staffing Duties

Roadway

Law Enforcement: Slow traffic flow ahead of the operation

Vehicle Profiler (2):

- Tallies vehicle numbers onto log sheet
- Assesses vehicle for secondary referral
- Marks referred vehicle with flagging tape or radios ahead
- Provides EAB literature to drivers waved through

Flagger (1):

- Directs cars into inspection area and out of inspection area

Inspection Area

Interviewer/Inspector (4 – two teams):

- Greet and present identification
- Ask drivers where they are coming from and if they are carrying firewood
- Ask to inspect the vehicle
- If no firewood found thank the driver, provide EAB pamphlet, remove flagging, and direct back into traffic
- If illegal hardwood firewood is present seize and safeguard, explain why firewood is illegal, complete survey record and a PPQ 523 EAN, take pictures of firewood with an identifier in the picture
- Inform the driver about penalty procedures

Other

Staff to relieve other positions (1-2)

Supervisor (minimum 1)

Total Staffing = 10 (numbers may be reduced if low volume roadway is selected)

#1 Priority – Safety

#1 Priority -- Courtesy

Vehicle Log

State Department of Agriculture
 United States Dept. of Agriculture

Firewood Stop
 Location:

Time (use hour intervals)	# of Commercial Vehicles	# of Cars (sedans)	# of RVs	# of Trucks (SUVs, Vans)	# of Referrals	# Inspections Conducted
Totals:						

Vehicle Log

State Department of Agriculture
United States Dept. of Agriculture
Remarks:

Firewood Stop
Location:

Cooperative Emerald Ash Borer Project

Regulatory Special Operation

(Fill out for each traveler carrying regulated articles)

Inspector Name: _____ Agency: _____ Date: _____

Operation Stop Location: _____ Time: _____

<p>Identification and Origin of Individual LICENSE PLATE # IS MANDATORY</p>	<p>Name: _____ Address: _____ _____ City: _____ State: _____ Zip: _____ Phone: _____ License Plate (including state): _____</p>
<p>Individual/Regulated Item Destination (Campground, Business, etc.) COUNTY IS MANDATORY</p>	<p>Enter Destination Information here: COUNTY _____</p>
<p>Regulated Item Origin</p>	<p>Inside quarantine? _____ Yes _____ No Origin if different than traveler (county, address, etc.):</p>
<p>Traveler aware of EAB Quarantine/Regulations?</p>	<p>_____ No _____ Yes (if yes, how?) How? _____</p>
<p>Regulated Item Type: _____ Nursery stock _____ Logs/Lumber _____ Firewood _____ Other</p>	<p>If firewood mark blanks as appropriate: _____ Commercial Package _____ Non-commercial Ash present _____ Yes _____ Unknown</p>
<p>Amount of Regulated Item</p>	<p>_____ Piece Count _____ Estimated Weight</p>
<p>Regulatory Action</p>	<p>Seizure? _____ Yes _____ No If no why not? _____</p>
<p>Evidence of EAB –check those that apply→ EAB Inspection not conducted: _____</p>	<p>_____ D shaped exit holes _____ Bark splits _____ Serpentine galleries _____ EAB life stage</p>
<p>Comments:</p>	

Cooperative Emerald Ash Borer Project

Regulatory Special Operation

(Fill out for each traveler carrying regulated articles)

Inspector Name: _____ Agency: _____ Date: _____

Operation Stop Location: _____ Time: _____

--

Inspector Name: _____ Date: _____

Regulatory Contact

Concern or Business Name: _____

Contact Name: _____

Street Address: _____ City: _____

State: _____ Zip Code _____

County: _____

GPS Lat _____ Long _____

Phone: _____

Concern Type (circle up to three)

Nursery / Garden Center / Firewood Dealer / Public Campground / Private
Campground / Milling & Manufacturing / Landscaper / Research / Municipality /
Tree Removal Service / Landscaper / Logging Company / Misc. / Pallets / Pallet
Stock / Mulch

Aware of EAB Quarantine Y or N If yes,
how? _____

Interstate Movement Y or N

What/Commodity?

Frequency of shipments?

Quantity per shipment?

Final Destination of shipments?

From area near EAB positives?

Shipping Documents Available?

***Signature below confirms representative(s) of the Cooperative Emerald
Ash Borer Project contacted the signatory individual and gave them an
information packet about Emerald Ash Borer.***

Printed Name: _____

Signature: _____

Date: _____

Survey of Ash

Ash Product	Present? Y or N	Origin	Quantity	Inspected? Y or N	How long has the material been on site?
Firewood					
Nursery Stock					
Estab. Ash					
Ash Chips/Mulch					
Saw Logs					
Other					

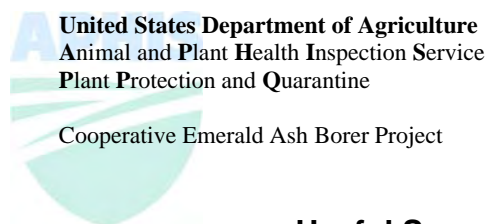
Campground Survey

	Ash firewood Present? Y or N	% OH plates	% MI plates	% IN plates	Local Firewood Available	Permanent Campsites Present
Private Campground						
Public Campground						

EAB symptoms or specimens present Y or N,
 If yes record ash product and X all indicators that apply.
 Ash Product: _____

Crown Dieback	Life Stage	D-shaped holes	Bark splits	Epicormic shoots	Serpentine Gallery	Die-Back	Woodpecker Damage

Remarks:

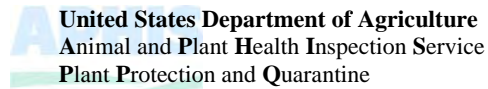


Identification of Regulatory Concerns Useful Sources

Useful Sources to Identify Regulatory Concerns

A variety of methods are used by EAB regulatory staff to locate individuals/businesses that present a risk of spreading EAB. Below is a list of some of those that have been most effective along with some examples.

1. Physical Reconnaissance
2. Phone Directory Yellow Pages
 - a. Sources
 - Superpages.com
 - Switchboard.com
 - Yellowbook.com
 - Google.com
 - b. Keywords
 - Firewood
 - Lumber Wholesale
 - Sawmills & Planing mills
 - Campgrounds
 - Logging
3. Internet Auctions
 - a. Ebay
4. Trade magazines
 - a. Physical magazines
 - b. Internet newsletters
 - <http://www.timberlinemag.com/aboutTL.asp>
 - <http://www.timberpa.com/index2.htm>
 - <http://www.timberbuyer.net/forum.shtml>
 - <http://www.logsplitters.com/ArborAssociations.html>
5. Internet Chats/Blogs
 - a. Firewoodcenter.com
 - b. Firewood.com
6. Internet Search Engine
 - a. Google
 - b. Yahoo
 - c. MSN



United States Department of Agriculture
Animal and Plant Health Inspection Service
Plant Protection and Quarantine

Cooperative Emerald Ash Borer Project

Identification of Regulatory Concerns
Useful Sources

7. State records
 - a. LLC/Inc. registrations
8. County records
 - a. DBA (Doing Business As) Licenses
9. Forest Industry Directories
 - a. State Dept. Natural Resource
<http://www.michigandnr.com/wood/>
 - b. Forest Service
<http://www.srs.fs.usda.gov/econ/econhome.htm>
10. County Health Departments
Public Health - many states test private campground water sources
11. Personal Referrals
12. Targeted Operations

The information requested is voluntary, and is needed to record your knowledge of possible irregularities under the USDA Plant Protection and Quarantine Program.

U.S. DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE
PLANT PROTECTION AND QUARANTINE

SERIAL NO. **A 229511**

REPORT OF VIOLATION

<p>3. WHERE INTERCEPTED (<i>City or Port, and State; also county if domestic</i>)</p> <p>5. ARTICLE MOVED IN VIOLATION OF REGULATIONS</p> <p>7. NAME AND BUSINESS ADDRESS OF VIOLATOR (<i>Shipper, caterer, cleaner, garbage handler, servicing agent, broker, ship's agent, etc. Identify which</i>)</p> <p>10. NAME AND BUSINESS ADDRESS OF CARRIER</p> <p>12. IDENTITY OF CARRIER PLANE Acft. No. Flight No. SHIP Flag Name ROAD VEHICLE License No.</p> <p>14. DISPOSITION OF PEST RISK (<i>i.e., articles named in Item 5 were fumigated, destroyed, etc.</i>)</p> <p>15. REMARKS (<i>Attach additional sheet, if needed</i>)</p> <p>16. VIOLATOR OR CARRIER'S STATEMENT OF VIOLATION (<i>Attach additional sheet, if needed. Identify who gave statement.</i>)</p> <p>17. OFFICER'S STATEMENT: Must attach a detailed, signed, and dated statement. State how the action violated the regulations or compliance agreement cited in Item 2. Describe fully the facts of the violation from discovery through disposition of pest risk including when, who, what, and where.</p> <p>18. SIGNATURE OF INITIATING OFFICER</p> <p>21. OFFICER IN CHARGE COMMENTS (<i>Attach additional sheet, if needed</i>)</p> <p>List Previous Violations</p> <p>Recommendations</p> <p>22. SIGNATURE OF OFFICER IN CHARGE</p>	<p>1. DATE VIOLATION DISCOVERED</p> <p>2. VIOLATED - REG/COMPL. AGREEMENT</p> <p>4. ORIGIN OF ARTICLE (<i>Include county if domestic</i>)</p> <p>6. IDENTITY OF ARTICLE (<i>Serial No., Waybill No., description, etc.</i>)</p> <p>8. VIOLATOR HAD Compliance agreement? <input type="checkbox"/> Yes <input type="checkbox"/> No Permit? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>9. IF NO, VIOLATOR WAS AWARE OF REGULATION? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown if "Yes," how informed and when?</p> <p>11. CARRIER WAS AWARE OF REGULATION? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown if "Yes," how informed and when?</p> <p>13. NAME AND BUSINESS ADDRESS OF CONSIGNEE</p> <p>19. PRINTED NAME OF OFFICER AND WORK UNIT</p> <p>20. DATE REPORT COMPLETED</p> <p>23. PRINTED NAME OF OFFICER IN CHARGE AND WORK UNIT</p> <p>24. DATE SIGNED</p>
--	---

U.S. DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE
PLANT PROTECTION AND QUARANTINE

EMERGENCY ACTION NOTIFICATION

3. NAME AND QUANTITY OF ARTICLE(S)		SERIAL NO.	
		1. PPQ LOCATION	2. DATE ISSUED
6. SHIPPER		4. LOCATION OF ARTICLES	
		5. DESTINATION OF ARTICLES	
9. OWNER/CONSIGNEE OF ARTICLES Name: _____ Address: _____ _____ _____ PHONE NO. _____ FAX NO. _____ SS NO. _____ TAX ID NO. _____		7. NAME OF CARRIER	
		8. SHIPMENT ID NO.(S)	
		10. PORT OF LADING	11. DATE OF ARRIVAL
		12. ID OF PEST(S), NOXIOUS WEEDS, OR ARTICLE(S)	
		12a. PEST ID NO.	12b. DATE INTERCEPTED
		13. COUNTRY OF ORIGIN	14. GROWER NO.
		15. FOREIGN CERTIFICATE NO.	
		15a. PLACE ISSUED	15b. DATE

Under Sections 411, 412, and 414 of the Plant Protection Act (7 USC 7711, 7712, and 7714) and Sections 10404 through 10407 of the Animal Health Protection Act (7 USC 8303 through 8306), you are hereby notified, as owner or agent of the owner of said carrier, premises, and/or articles, to apply remedial measures for the pest(s), noxious weeds, and or article(s) specified in Item 12, in a manner satisfactory to and under the supervision of an Agriculture Officer. Remedial measures shall be in accordance with the action specified in Item 16 and shall be completed within the time specified in Item 17.

AFTER RECEIPT OF THIS NOTIFICATION, ARTICLES AND/OR CARRIERS HEREIN DESIGNATED MUST NOT BE MOVED EXCEPT AS DIRECTED BY AN AGRICULTURE OFFICER. THE LOCAL OFFICER MAY BE CONTACTED AT:

16. ACTION REQUIRED

TREATMENT: _____

RE-EXPORTATION: _____

DESTRUCTION: _____

OTHER: _____

Should the owner or owner's agent fail to comply with this order within the time specified below, USDA is authorized to recover from the owner or agent cost of any care, handling, application of remedial measures, disposal, or other action incurred in connection with the remedial action, destruction, or removal.

17. AFTER RECEIPT OF THIS NOTIFICATION COMPLETE SPECIFIED ACTION WITHIN (Specify No. Hours or No. Days):	18. SIGNATURE OF OFFICER:
--	---------------------------

ACKNOWLEDGMENT OF RECEIPT OF EMERGENCY ACTION NOTIFICATION

I hereby acknowledge receipt of the foregoing notification.

SIGNATURE AND TITLE:	DATE AND TIME:
----------------------	----------------

19. REVOCATION OF NOTIFICATION

ACTION TAKEN: _____

SIGNATURE OF OFFICER:	DATE:
-----------------------	-------

PPQ Form 530 – (Limited Permit)

No. C-325575

Information requested is needed to determine if a permit can be issued (7 CFR 301).
 FORM APPROVED: CMB NOS. 0579-0068 & 0579-0123
 See reverse side for additional information.

U.S. DEPARTMENT OF AGRICULTURE
 ANIMAL AND PLANT HEALTH INSPECTION SERVICE
 PLANT PROTECTION AND QUARANTINE

LIMITED PERMIT

This permit authorizes the movement of the NONCERTIFIED articles described below to a specified destination for limited handling, utilization, or processing, or for treatment. The movement of such articles is regulated by Federal or State cooperative domestic plant quarantines.

1. DATE ISSUED	2. VOID AFTER
3. NAME OF CONSIGNOR	
4. SHIPPING POINT	
5. NAME AND ADDRESS OF CONSIGNEE	
6. VEHICLE LICENSE NO. & STATE	
7. R.R. CAR INITIALS	

B. DESCRIPTION

A. Quantity	B. Article	C. Remarks

9. SIGNATURE OF ISSUING OFFICER

ENDORSEMENT

The above described shipment was received by the designated consignee, and was handled in the manner approved under the provisions of all applicable Federal or State cooperative domestic plant quarantines.

10. DATE RECEIVED
11. SIGNATURE OF DESTINATION OFFICER

PENALTY FOR MISUSE OR ALTERATION (7 USC 163)

PPQ FORM 530 (FEB 2002)
 Previous edition dated APR 88 may be used.

PART 1 - CONSIGNEE'S COPY

U.S. GOVERNMENT PRINTING OFFICE: 2002-722-410

PPQ Form 540 – (Certificate)

FORM APPROVED
OMB NO. 0579-0088

Information requested is needed to determine if a permit can be issued (7 CFR 301). See reverse side for additional information.

E 089704

U.S. DEPARTMENT OF AGRICULTURE
Animal and Plant Health Inspection Service
Plant Protection and Quarantine
CERTIFICATE
This certificate must be surrendered to the consignee at destination of shipment.

The articles described below are certified under all applicable Federal or State cooperative domestic plant quarantines.

1. DATE ISSUED _____ 2. VOID AFTER _____

3. NAME OF CONSIGNOR _____

4. SHIPPING POINT _____

5. NAME & ADDRESS OF CONSIGNEE _____

6. VEHICLE LICENSE NO. & STATE _____ 7. R.R. CAR INITIALS & NO. _____

8. DESCRIPTION

A. Quantity	B. Article	C. Remarks

9. SIGNATURE OF ISSUING INSPECTOR _____

PENALTY FOR MISUSE OR ALTERATION (7 USC 163) MP07 ORR

PPQ FORM 540 (APR 89) Previous edition obsolete. **PART 1—CONSIGNEE**