

Working Document

The Arnold Arboretum of Harvard University

Asian Longhorned Beetle (ALB) Management and Response Plan

1. Introduction

The Asian Longhorned Beetle, (*Anoplophora glabripennis*), is native to Asia and was first discovered in North America in Brooklyn, New York in 1996 where it is believed to have arrived within the solid wood packing material used to construct crates for shipping cargo. In subsequent years, the ALB has been discovered in Chicago (1998), New Jersey (2002 and 2004) and Toronto (2003) and was most recently detected in Worcester, MA in August 2008.

The ALB feeds on a wide host of hardwoods including first and foremost its favorites: maples, horse chestnuts, birches, willows and elms. The ALB has also been known to feed on an extended list of trees including but not limited to mimosa, hackberries, katsuras, ashes, sycamores, poplars, mountain ashes and lindens. It will attack healthy trees as well as stressed trees and typically begins its infestation in the upper canopy of the tree making detection from the ground challenging. The beetle will eventually make its way down the tree to the root flare and only flies to the nearest host tree, once the tree becomes overpopulated.

Some of the distinctive signs of the ALB infestation are the large almost perfectly round 3/8" - 1/2" adult beetle exit holes that can be found along both the trunk and branches, the chewing pattern along the veins of a leaf, the football shaped oviposition site found on the bark of the tree, sap flow and frass near the exit holes and oviposition sites and the beetle during the warm days of July through November. While all these signs are created by the adult beetle, it is the larvae that remains unseen and that does the most damage to the tree and eventually kills it by tunneling into the tree to feed, thereby interrupting the tree's flow of water and nutrients.

Original news reports from Worcester reported the infestation at 15 trees and a federal and state regulated quarantine area at 16.2 square miles. These numbers quickly increased to 150 infested trees on 9/2/08 to 1265 trees on 9/30/08 to over 1800 on 10/30/08. The regulated quarantine area doubled in size to 32 square miles on 9/19/08 and again to 62 square miles on 10/30/08. As of December 4, 2008 the number of infested trees is at 4500 and the declared regulated area increased slightly to 63 square miles and includes the entire city of Worcester and the towns of Shrewsbury, Holden, Boylston and West Boylston. Reports claim that the ALB is now believed to have been in this area for seven to ten years before it was first detected. It is anticipated that these numbers will continue to grow as the trained inspectors continue to survey the trees in the Worcester area over the next several years.

At present, the furthest point east on the regulated quarantine area is Route 140 in Shrewsbury, which is approximately 40 miles from the Arnold Arboretum. With the increase emergences of invasive exotic pests, it may only be a matter of time before this destructive pests makes its way to the Arnold Arboretum and we want to be prepared for it when and if it does arrive.

2. History and significance of the Arboretum Collections

The Living Collections of the Arnold Arboretum are essential to achieving its mission as a research institution dedicated to improving the understanding, appreciation and preservation of woody plants. As a national and international resource for research in the various fields of plant biology and beyond, the Arboretum's Living Collections are actively developed and managed to support scientific investigation and study, as well as key educational and amenity roles. (The Living Collections Policy September 10, 2007)

The collections are considered to be one of the largest and best documented woody plant collections in North America and the world. (Inventory of Living Collections 2007) At present, January 28, 2009, the living collections comprise 14,488 individual plants including trees, shrubs and vines from around the world. Records have been kept for each of these plants and are currently maintained on a relational database called BG-BASE™. Maps with the location of each plant were first hand drawn in 1938. At present, our maps are maintained with a computerized mapping system using AutoCAD and Trimble® ProXR, a Global Positioning System (GPS). Labels with accession number, botanical name, family, provenance data, and/or lineage number are hung on each plant.

Furthermore, as part of its commitment to the North American Plant Collections Consortium (NAPCC), the Arboretum actively maintains and develops its *Acer* collection for the purposes of plant conservation, evaluation, and research. As of January 28, 2009, there are 398 *Acers* representing 131 taxa in the permanent collection.

3. Monitoring

A systematic monitoring program will be implemented and coordinated by the Manager of Horticulture and will be performed for a period of time in both the winter when it's easy to see the signs without the interference of foliage and in the summer when the ALB is active and there are more signs to see.

In house ALB monitoring training will be provided for all horticultural staff. At all times of the year, Horticultural Technologists and Arborists will be looking for signs of the beetle.

All surveyors will be trained to look for the following signs of the ALB, including but not limited to:

- In the winter, look for:
 - Round exit holes 3/8" - 1/2" in diameter on the trunk or branches. Can be verified with the pencil test and subway card.
 - Oviposition sites in the bark with the characteristic mandible chewing pattern and football shape.
- In the summer, look for:
 - Round exit holes 3/8" - 1/2" in diameter on the trunk or branches. Can be verified with the pencil test and subway card.
 - Oviposition sites in the bark with the characteristic mandible chewing pattern and football shape.
 - The distinctive chewing patterns along the veins of a leaf or its petiole.
 - Frass accumulated at the base of the tree or where branches meet other branches.
 - Sap flow, particularly on *Acers* near the oviposition sites.
 - Adult beetles 3/4 to 1 1/4 " long with a jet black body, mottled white spots on its back and long antennae.

All suspicions of ALB will be reported to the Manager of Horticulture.

This aggressive monitoring program enables earlier detection of the ALB making it easier to eradicate.

Host species on the perimeter of the Arboretum will be surveyed. Arnold Arboretum Arborists will complete this survey twice a year.

For efficiency sake and whenever possible, monitoring will be done from the ground using the naked eye and / or a pair of high powered binoculars. All surveys, regardless of the height of the tree, should begin with a ground survey and then move to an aerial survey, if necessary using the following protocol adapted from <http://www.uvm.edu/albeetle/awareness/index.html> and http://www.aphis.usda.gov/plant_health/plant_pest_info/asian_lhb/downloads/alb_response_guidelines.pdf

Ground Survey Protocol:

1. Pick a sunny day. ALB and its damage are harder to see in the rain or on a cloudy day. Damage can be spotted at any time of the year.
2. Start the inspection by first examining the exposed root areas and the root collar. Infestations may be found at lower levels of the tree and this should not be ignored. Particular attention should be paid to the root collar area of small diameter trees including the necessity to pull back leaf litter to view the root collar area.
3. Continue the inspection by slowly circling the tree, scanning the lower branches and the trunk for signs and damage.
4. Using binoculars stand in one spot about, five feet away from the tree and slowly scan the trunk and branches for damage looking all the way to the top of the tree.
5. Move ¼ of the way around the tree and repeat step #3 and #4 until you have completely circled the tree.
6. Ladders may also be used to scout the upper portions of the tree.
7. The time required for inspection may increase when foliage is present.

Because all trees cannot be completed from the ground, aerial surveys, using the bucket truck and climbing crews will be implemented using the following protocols adapted from http://www.aphis.usda.gov/plant_health/plant_pest_info/asian_lhb/downloads/alb_response_guidelines.pdf

Bucket Truck Survey Protocol:

1. Begin with a ground survey.
2. Position the bucket above the canopy of the tree and whenever possible position the bucket with the sun at your back. ALB and its damage are harder to see in the rain or on a cloudy day. Damage can be spotted at any time of the year.
3. Examine the branches carefully using the naked eye and / or a pair of high powered binoculars. Begin with the main leader and work your way out from the crotches and collars along the branches.
4. Examine any suspicious area with the binoculars at first and then maneuver the bucket up to the site as necessary to get a closer look.
5. Move to the inside of the canopy and continue to examine the upper and lower branches.
6. Continue the inspection of the tree by moving to all sides of it.
7. The time required for inspection may increase when foliage is present.

Climbing Crew Survey Protocol:

1. Begin with a ground survey.
2. Pick a sunny day. ALB and its damage are harder to see in the rain or on a cloudy day. Damage can be spotted at any time of the year.
3. Begin with the main leaders and carefully examine all branches.
4. Examine any suspicious area with the binoculars at first and then maneuver to the site as necessary to get a closer look.
5. Move throughout the entire tree examining all surfaces.
6. The time required for inspection may increase when foliage is present.

All surveyors will record their results on the forms in the ALB monitoring kits provided by the Manager of Plant Health.

All completed forms will be returned to the Manager of Plant Health and all survey results and methods will be recorded in the horticultural task menu in BG-BASE™ by the Manager of Plant Health or the Plant Records Department.

4. Detection and Response

All ALB sightings will be immediately reported to the Manager of Horticulture.

The Manager of Horticulture will immediately report all ALB sightings to the Massachusetts Asian Longhorned Beetle Cooperative Eradication Program by calling the Pest Alert Hotline at 1-866-702-9938 or by going to: <http://www.massnrc.org/pests/albreport.aspx> .

The genus and species, accession number and map quadrant of the tree where the ALB and/or suspicious activity was discovered will be recorded. If the tree is not accessioned it will be identified with orange flagging tape.

If sighted, the beetle will be collected in a glass jar and given to the Manager of Horticulture. A digital image will be taken and the beetle will be placed in a freezer. Until the identification of the beetle is verified by the Massachusetts Asian Longhorned Beetle Cooperative Eradication Program, it will be treated as if it were the ALB which means trees, logs, branches, roots or other woody debris larger than one half inch in size on any two sides will not be moved by Arboretum staff.

If necessary, horticultural staff, under the direction of the Manager of Horticulture, will be mobilized to further survey the infested tree and nearby host trees.

The Arboretum staff will work with sister agencies at the Federal, State and local levels to help eradicate the ALB. The Plant Records Department will provide copies of maps and inventories of collections requested by the sister agencies to assist them in their surveying process.

5. Control and Removal

A select number of host trees will be chosen to receive the insecticide Imidacloprid™.

All treatments will be recorded in the Horticultural Tasks menu in BG-BASE™ by the Manager of Horticulture or the Plant Records Department.

Pesticide treatments by the Arboretum may be increased at any time. The horticultural staff may apply Imidacloprid™ to prevent the establishment of the ALB through soil or trunk injection.

As of June 1, 2010, seventeen members of the Arboretum horticultural staff hold Massachusetts pesticide licenses who may be deployed at any time to apply Imidacloprid™. Additionally, ten of these horticultural staff members hold Maujet certificates. The Arnold Arboretum possesses an assortment of equipment including: two 50, three 100, one 300 and one 600 gallon spray tanks, four Kioritz hand soil injectors and one Arborjet Tree I.V. kit that are available for use to apply Imidacloprid™.

Arboretum horticulture staff will offer APHIS assistance in the tree removal process to insure that further damage (i.e. compaction) is not sustained by surrounding trees and that all heavy equipment (i.e. bucket trucks, cranes, front end-loaders) remain on paved roads unless given prior approval to go off road by the Manager of Horticulture.

The Mesa, a parcel of land located within the Bussey Brook Meadow of the Arboretum will be suggested to serve as the designated quarantine site for the Arboretum and could be used to store contaminated chip, wood, stump grindings and any other woody debris upon approval from APHIS. Under no circumstance, should any of this material be brought to the Arboretum's composting facility at the quarry site.

6. Public Awareness and Communication

The Harvard News Office will be notified by the Manager of Horticulture or Director of External Relations immediately following the call to the Pest Alert Hotline.

The Director of External Relations will coordinate all communications with the public regarding the ALB.

7. Replanting

The Arboretum will assume responsibility for replanting trees and the Horticultural Managers Group (Director of Finance and Administration, Curator, Manager of Horticulture, and Manager of Greenhouse and Nursery) will create planting lists based on the Arboretum's collection's policy.

S. Schneider
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