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THE ASIAN LONGHORNED BEETLE: AN INVASIVE PEST OF TREES



The Asian Longhorned Beetle

The Asian longhorned beetle (*Anoplophora glabripennis*) (ALB) is an invasive pest from Asia that came to the United States concealed in solid wood packing material (SWPM), the pallets and crates used to transport goods from overseas. Nobody is sure exactly when the first ALB arrived here.



Figure 1—An adult male ALB on a striped maple.

This insect is a serious threat to many species of deciduous hardwood trees in the United States (e.g., maple, elm, willow, birch, horsechestnut, and poplar). During its larval stage, the ALB bores deep into a tree's heartwood, where it feeds on nutrients. This tunneling damages, and eventually kills, the tree.

If the beetle were to become established here, it could be one of the most destructive and costly invasive species ever to enter the United States. It threatens urban and suburban shade trees and recreational and forest resources valued at hundreds of billions of dollars. It might also impact such industries as maple syrup production, hardwood lumber processing, nurseries, and tourism. If it became widely established, its impact would be felt in urban, suburban, and forested parts of the country.

Since its first discovery in Brooklyn, NY, in 1996, the beetle has been detected in a total of five U.S. States—New York (1996), Illinois (1998), New Jersey (2002), Massachusetts (2008), and Ohio (2011)—and in Toronto and Vaughan, Ontario, Canada. Alert workers have reported the beetle in warehouses in other parts of the United States, where the insects were destroyed before they could escape to start new infestations.

The U.S. Department of Agriculture's (USDA) Animal and Plant Health Inspection Service (APHIS) cooperates with State and local governments and residents of affected areas to find and destroy ALB infestations. For USDA's eradication efforts to be completely successful, Americans in infested and noninfested areas must remain vigilant for this invasive and destructive pest.

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This publication supersedes Program Aid No. 1655, "WANTED: The Asian Longhorned Beetle," which was originally issued in 1998 and last revised in April 2008.

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Photo credits: All the pictures in this brochure were taken by employees of APHIS. The photos in figures 1–4 were shot by David Lance, those in figures 5 and 6 by Alan Sawyer, those in figures 7, 8, 11, 12, 13, 16, 17, and 18 by APHIS photographer R. Anson Eaglin, those in figures 9 and 10 by Marlene Bombara, and those in figures 14 and 15 by Robert Benjamin. The last picture is from the APHIS photo library.

Cover photos were taken by Alan Sawyer (ALB insect), Marlene Bombara (photos of technicians performing a ground survey and the tree canopy survey by USDA climber), and Robert Benjamin (imidacloprid injection) of USDA.

Meet the ALB

The adult beetle is a large, distinctive-looking insect measuring 1 to 1.5 inches long, not including its antennae. These antennae, which give the insect its common name, are as long as the body itself in females and almost twice the body length in males. The insect's body is shiny black with white spots; the antennae are banded in black and white. During summer months, adult beetles can be spotted on walls, outdoor furniture, cars, sidewalks, tree limbs, and branches.

Many different hardwood tree species can host the beetle and are therefore at risk of infestation. Host trees include all species of maple (Norway, sugar, silver, red, and boxelder), elm, willow, birch, horsechestnut, London planetree, poplar, ash, mimosa (silk tree), mountain ash, hackberry, katsura, and golden raintree. While these beetles can fly for distances of 400 yards or more in search of a host tree, they tend to lay eggs in the same tree from which they emerged as adults until the insect population becomes too dense on that tree.



Figure 3—ALB larva.



Figure 4—ALB pupa surrounded by frass.

Adult beetle activity is most obvious during the summer and early fall. A mated female chews 35 to 90 individual depressions, called oviposition sites, into the bark of a host tree. She lays a single egg beneath the bark at each site. After the egg hatches in 10 to 15 days, the white larva tunnels in the phloem and cambium layers beneath the bark. After several weeks, the larva tunnels into the woody tree tissue (xylem), where it continues to feed and develop over the winter.

In the spring, beetle larvae inside the host tree start to develop (pupate) into adults, only to emerge in summer, when the fully developed adult beetles chew their way out, leaving perfectly round exit holes one-fourth to one-half inch in diameter. As each beetle emerges, it often pushes sawdust-like material, called frass, out onto the ground or onto tree branches.

ALB adults feed on small twigs and leaves and then mate, beginning the cycle again. Adult beetles remain active only during the summer and early fall, when—depending on the climate—they begin to die as the weather turns colder.



Figure 2—ALB up close.

Battling the Beetle

Due to the danger the ALB poses to trees in the United States, the environment, and various industries, USDA's goal is to eradicate it by eliminating reproducing populations in the United States. Over the years, extensive data on the beetle has been collected, enabling the eradication program's government partners to refine the eradication protocols, or methods, used against the beetle to achieve this goal.



Figure 5—An adult ALB emerges, leaving a perfectly round exit hole.

Through years of study and field examination of the ALB in all its life stages, USDA knows that the protocols currently in use represent the best, science-based approach to ALB eradication available to date. And, with all cooperators working together, these protocols are effective against infestations.

The protocols used by the eradication program include regulatory requirements that limit the movement of host material, survey and detection activities to find infestations, control efforts that remove infested trees and treat trees against the ALB, restoration to replace lost trees, continued research into what constitutes best practices against the ALB, and public outreach and education.



Figure 6—An adult ALB rests beside its exit hole.

Regulatory Response Starts With ALB Quarantine Areas

To limit human-assisted spread of the ALB, officials from the Federal and State governments establish quarantines around detected ALB infestations. When they detect and verify an infestation, ALB eradication program employees examine, or survey, host trees located in proximity to infested trees to identify the extent of the infestation and set the quarantine boundaries.

Quarantines reduce the chance that human actions will transport ALB-infested host materials to new areas. Federal and State regulations require that no individual or business remove firewood, trimmed or downed branches, logs, stumps, roots, or other wood debris from an ALB quarantine area.

The ALB eradication program enters into compliance agreements with businesses, local government agencies, and industries operating within quarantine zones to regulate host material moved for commerce. Compliance agreements also establish the mitigation methods for the safe disposal of removed ALB host trees, tree trimmings, and woody debris. The ALB eradication program provides training for businesses and municipalities that work with or handle firewood, nursery stock, tree limbs, branches, and any other woody debris. People who live or do business within ALB quarantines should be in compliance with all regulatory requirements put in place to protect trees from ALB infestation.

If you have any questions about working or living within an area under active ALB quarantine, please get in touch with the ALB eradication program in your State. See the “Contacts” section at the end of this brochure for details.

As of June 2013, ALB quarantines exist in New York, including in Brooklyn and Queens and a portion of Nassau and Suffolk Counties. In Massachusetts, quarantines exist in Worcester County and portions of Norfolk and Suffolk Counties. In Ohio, quarantines exist in Clermont County. For the latest ALB quarantine information, go to www.aphis.usda.gov/ALB, visit www.AsianLonghornedBeetle.com, or contact the nearest ALB eradication program office. These offices are listed in the “Contacts” section at the end of this brochure.

Due to successful ALB eradication efforts, established quarantines have been lifted in Illinois (2008); Islip, NY (2011); New Jersey (2013); and Manhattan and Staten Island, NY (2013).

Homeowner outreach and education are also provided to inform people living in quarantine zones that Federal and State ALB eradication program employees must have access to private property to survey, treat, and remove infested host trees. Residents who live in an ALB quarantine zone and have questions should contact their local ALB eradication program office.



Figure 7—Surveys are performed by ALB program professionals, who look for any signs of ALB infestations high in host-tree canopies.

Inspectors are looking for exit holes, oviposition sites, and frass, all of which signal a possible ALB infestation. This is challenging work because signs of ALB infestation can be few and obscure—one or two egg sites or healed-over exit holes, for example. Other signs of infestation include sap flows from wounds caused by the ALB, unseasonable yellowing or dropping of leaves when the weather has not been especially dry, and broken, dead, or dying branches.

The ALB eradication program requires negative survey results to declare an area free of ALB infestation.



Survey and Detection: Constantly on the Lookout for the Beetle

APHIS and cooperating State inspectors survey for ALBs within and outside of the quarantine zone by examining individual host trees from the ground for signs of beetle damage. Tree climbers also perform year-round searches in host-tree canopies, carefully examining every tree limb and branch for signs of ALB infestation.

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Figure 8—Trained ALB program technicians are searching trees for signs of infestation, such as these multiple egg sites found on a New York tree.

Not all ALB-infested trees are as easy to spot as this one was. Nearly 200 exit holes and more than 1,550 egg sites dot the trunk and branches of this red maple in Massapequa, NY. It was infested in 2000 and discovered in 2005.

Control: Tree Removal and Treatment



Figure 10—Ground inspections are carried out by trained program professionals.

Research and experience have shown that host-tree removal is critical to ALB eradication. The ALB eradication program removes and chips infested host trees. In addition, host trees near infested trees may be cut and chipped because they, too, likely harbor undetected ALB eggs, larvae, or pupae. The chips are landfilled or incinerated; insects do not survive this treatment.

Control efforts can also include treating noninfested host trees in the quarantine area with the insecticide imidacloprid. Whether a host tree is treated or not is determined by its distance from the original infestation. The treatment reduces beetle populations and can prevent trees from becoming infested, protecting these trees and ensuring that an undetected ALB population cannot persist in the area.

In spring, imidacloprid is injected directly into the tree or into the soil at the tree's base. The insecticide disperses through the tree's vascular system to the smallest branches and twigs by the time adult beetles emerge in summer. ALB adults feed on the small twigs and leaves, ingest the chemical, and die. Young larvae tunneling under the bark may also ingest the insecticide and die.

Consumers use imidacloprid in some over-the-counter lawn and garden products, and some lawn-service companies use it to kill grubs in turf. Imidacloprid is also an ingredient in some domestic pet treatments used to kill fleas.

While imidacloprid can decrease beetle populations and help protect against future tree loss, APHIS removes every tree found to be infested even if it has been treated.



Figures 11 and 12—ALB host trees are cut and chipped, a process that destroys all ALB eggs, larvae, and pupae.



Figures 13 and 14—Imidacloprid is injected directly into the host tree or into the soil around the base of the tree, where it is taken up by the roots.

Replanting

Because trees are so vital to the urban and suburban landscape—preserving air quality and providing shade and cooling in the summer—APHIS works with State partners to replant nonhost trees on properties that have had trees removed because of the beetle eradication efforts. The goal is to ensure diversity of tree species while reinvigorating neighborhoods and streetscapes.

Research

Research is continuing in laboratories across USDA to refine and improve the Department's knowledge about invasive pests and diseases. U.S. scientists have even traveled to China to learn more about the insect known as the "starry night beetle" in its homeland. But, even in Asia, little scientific information was available back in 1996, when the beetle was first detected in the United States. Field studies and trials and laboratory research over the years have proven to be invaluable in developing the protocols used today to fight the ALB.

This research has disclosed a great deal of useful information about the ALB. First, it is now understood that the ALB has no known predators in the United States. Research has taught USDA scientists how far the beetle typically flies in search of new host trees. Scientists can now date infestations by evaluating the annual growth rings of infested trees and can even link infestations via insect DNA. Research has demonstrated that generations of ALBs will live in one or a few trees in a localized area before spreading out in search of new hosts in response to overcrowding or declining food resources. Scientific research guides all decisions on eradication strategies and protocols formulated by the ALB eradication program and its partners.



Figure 15—In New Jersey, woody debris from ALB program activities was chipped prior to incineration at a local cogeneration plant.

Public Outreach and Education

Sharing information about the ALB with homeowners and residents of affected areas is a critical component of the ALB program. An alert Brooklyn homeowner was the first to notice beetle damage on his trees and report it to authorities, leading to the discovery of this invasive pest in the United States. Since then, residents have been instrumental in helping to uncover infestations in New Jersey, Illinois, Massachusetts, and Ohio.



Figure 16—Planting nonhost trees to replace trees lost to eradication activities is an integral part of restoring ALB-ravaged communities.

In addition to detection, informed citizens and residents also understand the importance of granting program officials access to their property so the experts can search for signs of the ALB, apply treatments, and remove infested trees, if needed, before they impact entire neighborhoods.

Residents all across the United States should familiarize themselves with the ALB adult and with the signs of ALB infestation so they can report any possible ALB sightings to the proper authorities.



Figure 17—ALB program professionals share beetle information with a New Jersey homeowner.

Firewood Movement Can Spread the ALB

Human transport is a way that invasive diseases, pathogens, and insects, including the ALB, move. So residents must refrain from moving wood out of ALB quarantine areas. Cutting a tree into firewood does not kill any of the life stages of ALB living within it. When firewood is moved from a quarantine area to an area free of pests and sits without being burned, any larvae and pupae inside can continue to develop until they emerge from the firewood as adults and spread the infestation to nearby trees.

To protect against spreading invasive insects and diseases, it is best to leave firewood behind or purchase only USDA- or State-certified, treated, and labeled firewood. Many State parks and campgrounds will not let people bring in their own firewood. It will be confiscated and burned immediately.

APHIS' Role in Excluding Foreign Pests

In order to keep the ALB and other invasive pests from entering the United States, APHIS analyzes threats to U.S. agriculture and develops rules for importing commodities based on the risks they present.

The best way to fight the ALB and similar nonnative wood borers is to exclude such pests from the country. To stop ALBs from entering the United States, international regulations now require all SWPM imports to be heat treated, fumigated, or treated with preservatives before being sent to this country. Special stamps and paperwork must accompany shipments to verify which of the prescribed treatments took place. Items that do not meet regulations are returned to their country of origin.

Inspection specialists at U.S. ports are the first line of defense against exotic plant and animal pests and diseases. In addition, all international passenger baggage, cargo, packages, mail, and conveyances are subject to inspection upon entry into the United States to exclude exotic pests.



Figure 18—Specialists at U.S. ports inspect high-risk cargoes for the ALB and other pests.

Contacts

For more information regarding the ALB—including quarantine maps, photographs, publications, pest alerts, and other useful resources—please visit www.aphis.usda.gov and click on the button for Asian longhorned beetle under “Hot Issues.” Or visit the ALB information site at www.AsianLonghornedBeetle.com.

- To report a sighting of the beetle or signs of damage in a State other than New York, Massachusetts, or Ohio, please call **1-866-702-9938**, contact your nearest APHIS State Plant Health Director, or call the State department of agriculture or agricultural extension service. Contact information for the State Plant Health Directors can be found at this Web site: www.aphis.usda.gov/StateOffices. On the U.S. map, just click on the State of interest.
- Those living in New York may call: **1-866-265-0301** or **1-877-STOP ALB**.
- Those living in Massachusetts may call: **508-852-8090** or **1-866-702-9938**.
- Those living in Ohio may call: **513-381-7180** or **1-866-702-9938**.

ALB Eradication Programs Are a Partnership

ALB eradication programs are cooperative programs. APHIS works with USDA's Forest Service, Agricultural Research Service, and partnering organizations in each affected State. In Ohio, the cooperative eradication program is composed of the Ohio Department of Agriculture, Ohio Department of Natural Resources, Ohio State University Extension, and Clermont County. In Massachusetts, the cooperative eradication program is composed of the Massachusetts Department of Conservation and Recreation; Massachusetts Department of Agricultural Resources; the cities of Boston and Worcester; and the towns of Auburn, Boylston, Brookline, Holden, Shrewsbury, and West Boylston. In New York, the cooperative eradication program is composed of the New York State Department of Agriculture and Markets, the New York State Department of Environmental Conservation, and the New York City Department of Parks and Recreation.

