Introduction

The Tree and Wood Pests (TWP) program protects forests, private working lands, and natural resources from the Asian longhorned beetle (ALB), emerald ash borer (EAB), gypsy moths, and most recently shot hole borers (SHB). Numerous native hardwood tree species that are common throughout the United States are vulnerable to these pests. The U.S. Department of Agriculture’s Plant Protection and Quarantine (PPQ) program cooperates with Federal, State, Tribal, and local agencies, organizations, and institutions to conduct survey, regulatory, control, and outreach activities in 48 States to manage and, in some cases, eradicate these pests.

Conserving forests enhances the economic vitality of rural communities by supporting forest-related industries, recreation and tourism, and the overall livability of communities. The value of forest products that PPQ protects is over $200 billion (U.S. Forest Service 2014). In addition, trees in residential areas
lower cooling bills, filter pollutants from the air, decrease runoff, and improve residents’ quality of life (U.S. Environmental Protection Agency).

**Asian Longhorned Beetle**

The ALB threatens forest resources nationwide, as roughly 30 percent of U.S. trees are potential ALB hosts. The program’s ALB eradication activities prevent multi-billion-dollar losses to the maple syrup, timber, tree nursery, trade, and tourism industries.

ALB was first detected in Brooklyn, New York, in August 1996, and was later found in other areas of New York, Illinois, New Jersey, Massachusetts, Ohio, and in FY 2020, Charleston, South Carolina. The program has successfully eradicated ALB from Chicago, Illinois; Islip, Staten Island; Brooklyn, Queens, and Manhattan, New York; Jersey City, Middlesex County, and Union County, New Jersey; and Batavia, Stonelick, and Monroe Townships, Ohio. The program continues to match State and Federal quarantine boundaries and conduct activities in regulated areas of New York, Massachusetts, Ohio, and South Carolina.

PPQ’s eradication strategy for ALB includes surveys, regulatory inspections and quarantine restrictions, removal of infested and high-risk trees, and chemical treatment applications. PPQ conducts several cycles of surveys to determine the scope of infestation, establish a quarantine area, identify trees to remove or treat, determine if the pest has spread outside of the established quarantine area, and determine when to release an area from quarantine.

A survey cycle is the time it takes to complete a survey of a given area, which can take several years depending on the size of the area, the density and type of trees in the area, and type of landscape or land
use. Four years is the minimum amount of time between that last detection of the pest in a given area and the completed final survey cycle, when PPQ can declare eradication. PPQ provides ongoing support to evaluate new methods and protocols to combat regulated pests and tailors project responses to site-specific conditions, resulting in a more efficient program.

In FY 2019, the program began investigating the use of unmanned aerial systems (UASs) equipped with digital cameras as an additional survey tool. In FY 2020, the program planned to continue the investigation of this tool and its use. Due to travel related COVID-19 restrictions, much of the work did not occur at the planned pace in FY 2020 or FY 2021. The program will continue the study of these UAS in FY 2022. If successful, the Agency could use UASs to examine trees too risky to climb or in otherwise difficult to access areas, improving safety for program personnel and lowering the cost to survey these types of trees.

In FY 2020, PPQ, in cooperation with the South Carolina Clemson University’s Department of Plant Industry (DPI), placed 58.6 square miles under quarantine for ALB in South Carolina. This action was made in response to the June 4, 2020, confirmation of ALB at a residence in Charleston County, South Carolina. Following the “No Significant Impact” results of an environmental assessment, the program will proceed with using an eradication strategy similar to those used for other ALB infestations. The strategy includes removing infested trees and using, with the landowner’s permission, a combination of tree removal, tree girdling, and chemical treatment for trees that are within a half-mile radius of an infested tree.

If the landowner does not give permission for chemical treatments, the program will continue to survey and inspect trees, and remove or girdle them only if they become infested. As a result of these efforts,
PPQ and DPI expanded the quarantine area by 17.8 square miles in Charleston and Dorchester Counties due to the detection of additional infested trees and is currently 76.4 square miles in FY 2021.

**Emerald Ash Borer**

Another forest pest of concern is the EAB. In 2002, this pest was first detected in Michigan and has since been detected in 34 additional States and the District of Columbia. In FY 2021, PPQ deregulated the domestic EAB program.

EAB had spread beyond what a regulatory program could control. To more efficiently address EAB, PPQ initiated work towards rulemaking to deregulate EAB and redirect resources for controlling the spread of this devastating pest by expanding the application of biological control for EAB, investigating methods for integrated pest management (IPM) of EAB, and exploring ways to preserve ash resources. On September 19, 2018, PPQ published a proposed rule in the Federal Register to remove the EAB Federal domestic quarantine regulations. On December 15, 2020, PPQ published the final rule in the Federal Register, which ended the Federal EAB domestic quarantine with an effective date of January 14, 2021. The removal of the domestic quarantine regulations for EAB discontinued the domestic regulatory component of the EAB program.

In FY 2021, the EAB program transitioned from a program with domestic regulatory activities, to a program that focuses on non-regulatory methods for EAB management. These methods include using biological control agents, the continued development of IPM for EAB in urban and forested areas, and collaboration with the U.S. Forest Service on testing the breeding resistance of ash to EAB. PPQ also completed a roll-out communication plan for the EAB deregulation announcement to Congress, key stakeholders, and the public. Along with the communication plan, PPQ provided transition information
and training on EAB deregulation, the continuation of the EAB biological control program, and ongoing methods development for EAB mitigation using IPM strategies. This information was disseminated to state plant regulatory officials to ensure the use of proper EAB management procedures.

The program’s biological control initiative, which is designed to effectively manage EAB populations, provides a promising strategy, using four species of parasitic stingless wasps for long-term EAB management. In FY 2021, the biocontrol rearing facility in Brighton, Michigan, shipped more than 476,413 parasitoid wasps to State and Tribal cooperators for release at 153 sites in 104 counties in 25 States. To date, the EAB program has cumulatively released a total over 8 million parasitic wasps within 30 States and Washington D.C.

PPQ and cooperators continue to assess the impacts of the parasitic wasps on EAB populations and tree health at release sites and nearby areas. Field evaluations indicate the EAB parasitoid wasps and other EAB natural enemies are protecting sapling ash from EAB. The EAB biological control program has recovered the parasitic wasps in 22 States, demonstrating that the biological control agents are reproducing and becoming established.

In FY 2021, PPQ updated the content of the EAB program website. This content included, revising the EAB program manual, updating the Biological Control Release and Recovery Guidelines on field releases of the EAB parasitic stingless wasps, factsheets, and a new interactive map for known EAB infested counties. PPQ also continued public outreach on preventing the improper movement of firewood through the “Don’t Move Firewood” website.
Gypsy Moths

European Gypsy Moth (EGM) is a destructive pest for some of North America’s most beautiful and popular deciduous trees, including maples, oaks, and elms. This pest is established in all or parts of 20 northeastern, mid-Atlantic, and Midwestern States, as well as the District of Columbia. PPQ and State cooperators conduct regulatory activities in the quarantine area to prevent the human-assisted spread of the pest and the establishment of gypsy moth populations in non-quarantine areas. These efforts include inspection, treatment, and certification of regulated articles for movement from quarantine to non-quarantine (non-infested) areas.

The program issues compliance agreements and conducts public outreach to ensure that businesses and residents in infested areas comply with regulations to prevent long-distance spread of the pest. EGM also spreads naturally into areas bordering the quarantined zone. PPQ monitors the transition zone along the 1,200-mile-long border of the quarantine area to ensure that newly infested areas are added to the quarantined zone and regulated effectively. Working with the U.S. Forest Service (USFS) and the EGM Slow-the-Spread Foundation, PPQ and cooperators have greatly reduced the rate of EGM’s spread and eradicated isolated populations, preventing this pest from becoming a larger issue. In FY 2021, PPQ and State cooperators continued to conduct EGM surveys to detect, delimit, and eradicate any isolated populations.

Asian gypsy moth (AGM) is an invasive threat to North American urban and natural forests because of its broad host range, demonstrated damage potential, and its ability to compromise an effective management system that has taken nearly 100 years of research to assemble. AGM poses a particular risk to western areas because of its ability to hitchhike on shipping vessels from Asia. PPQ supports the exclusion of AGM through negotiations and support of offshore ship inspection and certification. Due to
an increase in AGM egg masses that were intercepted on ships in 2012, PPQ, the Department of Homeland Security's Customs and Border Protection, and the Canada Food Inspection Agency conducted increased outreach to the maritime shipping trade over the last several years.

In FY 2021, PPQ and State cooperators performed eradication treatments for Asian gypsy moth at a single location in Washington and for European gypsy moth at a single location in Minnesota. The program and its partners conducted delimiting surveys in California, Oregon, and Washington for AGM that were detected in FY 2018, FY 2019, and FY 2020.

**Shot Hole Borers**

Various non-native shot hole borers have been detected in several States and hosts, including numerous woody trees in forests and urban landscapes, cultivated tea, and avocado. Shot hole borers are also called ambrosia beetles because they have a symbiotic relationship with ambrosia fungi, which they vector from tree to tree. The fungi disrupt the vascular system of impacted trees. In recent years the polyphagous and Kuroshio shot hole borers and diseases they cause have been devastating riparian habitats in southern California and urban areas in other parts of California. At California's request, PPQ and USFS helped establish a working group, led by USFS, with the goal of strategically addressing the shot hole borers in California.

In FY 2021, PPQ continued to provide support for projects addressing the management of shot hole borers in California. As a result, PPQ identified several semiochemicals that could be used as attractants and repellents for shot hole borers. These semiochemicals come in the form of a pheromone or other chemical that conveys a signal in an attempt to modify the behavior of the shot hole borers. PPQ also
supported biological control efforts to determine host specificity of parasitoids on SHB populations.

PPQ plans to continue the work on these biological control projects in FY 2022.