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Animal and Plant Health Inspection Service

Spotted Lanternfly Control Program in the Mid-Atlantic Region

Environmental Assessment
May 2018

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I. Purpose and Need

The spotted lanternfly (SLF), *Lycorma delicatula* (White) (Hemiptera: Fulgoridae), is an invasive insect primarily known to affect Tree-of-Heaven (*Ailanthus altissima*), grapevine (*Vitis vinifera*), stone fruits (almond, apricot, cherry, nectarine, peach, and plum), and other tree species (apple, oak, pine, poplar, and walnut) (USDA-APHIS, 2018). If allowed to spread, this pest could seriously harm grape, apple, peach, stone fruit, and logging industries throughout the country. USDA-APHIS does not have specific data on the level of tree mortality SLF may cause over time; however, stress from attack by SLF could predispose native host trees and other plants to other pests and pathogens. Pest damage leading to changes in forest composition is well-characterized (McGarvey et al., 2015; Mikkelson et al., 2013). Both nymphs and adults of SLF damage host plants when they feed by sucking sap from stems and leaves. This reduces photosynthesis, weakens the plant, and eventually contributes to the plant's death. In addition, feeding can cause the plant to ooze or weep, resulting in a fermented odor, and the insects themselves excrete large amounts of fluid (honeydew). These fluids promote mold growth and attract other insects (PDA, 2018).

Adult SLF are approximately 1 inch long and one-half inch wide, appear in late July, and have large and visually striking wings. Their forewings are light brown with black spots at the front and a speckled band at the rear. Their hind wings are scarlet with black spots at the front and white and black bars at the rear. Their abdomen is yellow with black bars. Nymphs in their early stages of development appear black with white spots and turn to a red phase before becoming adults (PDA, 2018).

The SLF lays its eggs on smooth host plant surfaces and on non-host material, such as bricks, stones, and dead plants. Egg masses are yellowish-brown in color, covered with a gray, waxy coating prior to hatching. Eggs hatch in the spring and early summer. Egg masses can easily be transported long distances on a wide variety of non-food commodities such as rock, concrete, tile, and wood. SLF can walk, jump, or fly short distances, and its long-distance spread is facilitated by people who move infested material or items containing egg masses (PDA, 2018). Spreading SLF populations make it harder to eradicate this pest, and are associated with increased pesticide use that increases risks to human health and the environment. In 2017, CLIMEX modeling estimated the potential distribution of SLF (Jung et al., 2017; see Figure 1).

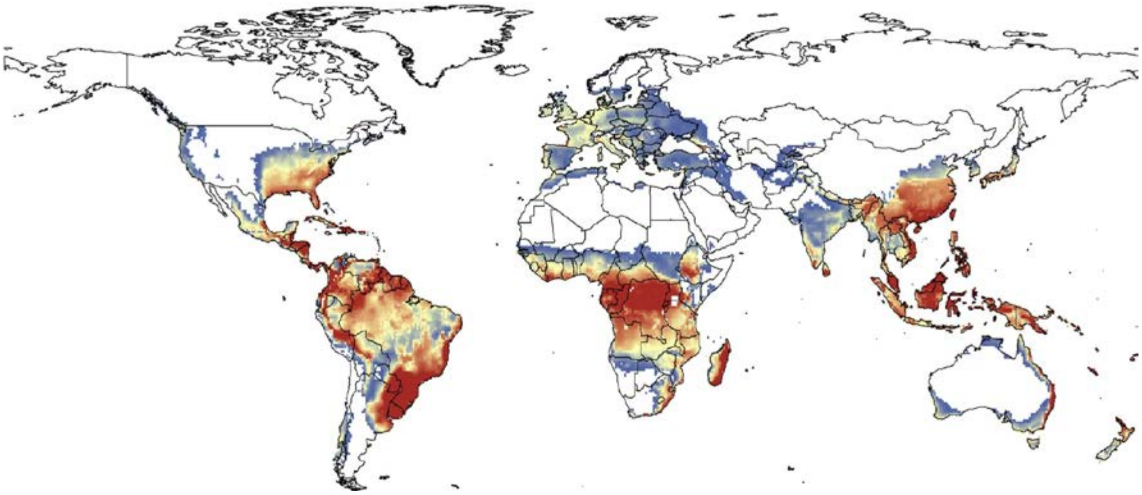

Figure 1. Predicted potential distribution of SLF by CLIMEX modeling. The ranges of red to blue coloration represent more favorable locations to unfavorable regions, respectively (Jung et al., 2017).

In the field of plant health, an outbreak is considered to be a recently detected pest population, including an incursion, or a sudden significant increase of an established pest population in an area (ISPM, 2007). An incursion occurs when an isolated population of a pest was recently detected in an area, is not known to be established, but is expected to survive for the immediate future (ISPM, 2007). At the present time, SLF incursions are ongoing in Pennsylvania and Virginia. In February 2018, the Virginia Department of Agriculture and Consumer Services announced SLF was detected in January outside of Winchester, VA[1]. This outbreak and the ongoing Pennsylvania incursion are being met with control programs as described in prior SLF Environmental Assessments (EAs) and their related decision documents, a Finding of No Significant Impact (FONSI). This EA incorporates all of the prior Spotted Lanternfly EAs and FONSIs by reference.[2]

On February 7, 2018 U.S. Secretary of Agriculture Sonny Perdue announced $17.5 million in emergency funding to stop the spread of the spotted lanternfly in southeastern Pennsylvania. This emergency funding, which was made available through existing Commodity Credit Corporation balances, would allow the USDA-APHIS in cooperation with the State of Pennsylvania to manage the current infestation. The goal of a combined expanded surveillance and control program would be to stop the leading edge of the infestation, and start pushing it inward while at the same time reducing the density of spotted lanternfly populations in the core of the infested area. As USDA-APHIS conducts additional survey work, the quarantine areas continue to expand. The affected area expanded

[1] https://ext.vt.edu/agriculture/commercial-horticulture/spotted-lanternfly.html

[2] These documents are available at: https://www.aphis.usda.gov/plant_health/ea/downloads/2015/slf-berks-lehigh-montgomery-pa.pdf , https://www.aphis.usda.gov/plant_health/ea/downloads/2015/spotted-lanternfly-fonsi.pdf , https://www.aphis.usda.gov/plant_health/ea/downloads/2016/fonsi-slf-march.pdf, and https://www.aphis.usda.gov/plant_health/ea/downloads/2018/slf-va-ea.pdf .

from 174 square miles in fiscal year (FY) 2016 to approximately 3,000 square miles by the end of FY 2017. The continuing survey and detection work conducted by State and federal entities will inform when and where additional Federal actions should occur.

The purpose of this programmatic EA is to increase preparedness by having a combination of program measures available for deployment wherever and whenever SLF outbreaks may occur so that control efforts can proceed upon pest detection. Program actions would be triggered by SLF detections in an area. When an outbreak presents new environmental issues, program methods would be deployed after the new environmental issues are considered in site-specific documentation.

This EA considers programmatic control efforts throughout the Mid-Atlantic States including: Connecticut, Delaware, Maryland, New York, New Jersey, North Carolina, Pennsylvania, Virginia, West Virginia, and the District of Columbia. The control experience gained in Pennsylvania is considered as representative of impacts throughout the potentially affected area.

APHIS has the responsibility for taking actions to exclude, eradicate, and control plant pests under the Plant Protection Act of 2000 (7 United States Code (U.S.C.) 7701 et seq.). This EA was prepared consistent with the National Environmental Policy Act of 1969 (NEPA) and the Animal Plant Health Inspection Service (APHIS) NEPA implementing procedures (7 Code of Federal Regulations (CFR) part 372) for the purpose of evaluating how the proposed action, if implemented, may affect the quality of the human environment. The proposed action does not meet the criteria for actions normally requiring environmental impact statement (7 CFR § 372.5(a)) based on the lack of significant impacts to the human environment associated with the as-needed deployment of control program methodologies.

II. Alternatives

The program components in the alternatives considered for this EA are essentially the same as in the "Spotted Lanternfly Eradication Program in Frederick County, Virginia, Environmental Assessment March 2018" (which is incorporated by reference) with expansion of the programmatic activities into all areas on an as-needed basis as the preferred alternative. Expansion would occur in both the number of treated areas and in the range of pesticides available for use.

A. No Action

Under the no action alternative, USDA-APHIS would provide existing funding to support efforts in areas where SLF control programs already exist. USDA-APHIS would not use regulatory controls, such as establishing Federal quarantines or commodity certification programs. Other government agencies and private landowners may work to eradicate SLF; however, there would be no cooperative or coordinated efforts among USDA-APHIS and other stakeholders. State workers, Federal District workers, and volunteers would be the primary providers of control efforts.

B. Preferred Alternative

The SLF control program is proposing a combination of measures to use in an integrated manner on an as-needed basis when there are SLF detections along the Mid-Atlantic region. USDA-APHIS expects additional detections may occur in Connecticut, Delaware, Maryland, New York, New Jersey, North Carolina, Pennsylvania, Virginia, West Virginia, and the District of Columbia within the reasonably foreseeable future. Control efforts may include any or all of the following: regulatory control, surveys, egg mass scraping, sanitation, tree removal, herbicide applications, and applications of insecticides (dinotefuran or imidacloprid on an as-needed basis).

The methods used in regulatory control, surveys, egg mass scraping, sanitation, tree removal, herbicide and insecticide applications for SLF control are described in the "Spotted Lanternfly Eradication Program in Berks, Lehigh and Montgomery Counties, Pennsylvania Environmental Assessment" which is incorporated by reference. Additional methods used in herbicide and insecticide applications are described in the "Draft Programmatic Asian Longhorned Beetle Eradication Program Environmental Impact Statement" published in 2015. The methods and risk evaluations associated with the program uses described in Appendices E and F (including human health risk assessments and ecological risk assessments for all pesticides) are incorporated by reference. The two recently prepared Environmental Assessments for Virginia and Pennsylvania[3] are incorporated by reference.

The SLF control program is proposing several measures to address the recent detections in Pennsylvania and Virginia. These same measures are proposed in other Mid-Atlantic States where SLF may be detected and require control. Control efforts may include any or all of the following: surveys, egg mass scraping, sanitation, tree removal, and insecticide and herbicide applications.

Detection Survey

Detection survey will use visual inspection and sweep netting to determine if SLF is present. Immature SLF crawl up trees each day and can be observed visually or

[3] Spotted Lanternfly Eradication Program in Select Counties of Pennsylvania Supplemental Environmental Assessment March 2018 available at: https://www.aphis.usda.gov/aphis/ourfocus/planthealth/plant-pest-and-disease-programs/sa_environmental_assessments/ct_slf and Spotted Lanternfly Eradication Program in Frederick County, Virginia Environmental Assessment March 2018 available at: https://www.aphis.usda.gov/plant_health/ea/downloads/2018/slf-va-ea.pdf

can be collected by sweep netting. Tree bands (discussed below) will also be used to detect infestations.

Visual Reconnaissance Survey and Egg Mass Scraping

Visual reconnaissance surveys identify locations that have feeding damage or presence of SLF on plants. The program is working with the local agricultural extension office to train local citizens to identify egg masses. The visual surveys will occur from October through May and volunteers and program personnel will scrape egg masses from plants and other objects with a stiff plastic card into bags with an alcohol solution to cause mortality.

Sanitation

Sanitation of all other greenwaste within 1/4 mile of SLF detections may include chipping or grinding the debris, and disposal through incineration or burning. Steaming, composting, and burial of greenwaste are options under consideration for the future.

Tree Banding

The program will place self-adhesive paper bands around *A. altissima* trees from SLF hatch in May to death of the adult population in November to capture SLF while they move up the trunk or congregate to feed and mate. Volunteers or program personnel will replace tree bands on a bi-weekly basis and report the number of SLF captured to develop data on the infestation and control achieved. Used bands will be bagged and placed in a landfill.

Tree Removals

Contractors for APHIS and its cooperators will remove *A. altissima* trees up to a quarter-mile radius from infested trees. When possible, APHIS prefers to physically remove host trees along with the stumps to prevent reinfestation. When it is impractical to move stump removal equipment into an area APHIS would have the option to apply herbicides to treat the remaining stumps and associated sprouts. APHIS needs a range of herbicide options to treat stumps and control vegetation sprouting from stumps of SLF-host species. In the Asian Longhorned Beetle (ALB) program, APHIS gained experience with using a combination of the herbicides triclopyr, imazapyr, and metsulfuron-methyl, and finds these same chemicals and methods of application may be useful for the SLF program (USDA APHIS, 2015). The SLF program is also proposing to use aminopyralid and glyphosate to treat stumps and sprouting vegetation. Not all herbicides would be used at one site but depending on whether stumps or sprouts need treatment, one or a mixture of herbicides may be used. These herbicide treatments are needed as a way to prevent reinfestation of host tree stumps and sprouts that have been removed as part of the SLF program. All applications will be made either by hand painting undiluted material on the stump or directly spraying stumps and sprouting foliage using a backpack sprayer.

The herbicide triclopyr imitates a plant hormone (indoleacetic acid) that is used to control woody plants and broadleaf weeds (USDA-FS, 2011a). Imazapyr is a systemic, non-selective imidazolinone herbicide used for the control of a broad range of terrestrial and aquatic weeds that works by inhibiting an enzyme involved in the biosynthesis of amino acids such as leucine, isoleucine and valine (HSDB, 2014a; USDA-FS, 2011b). Metsulfuron-methyl is a sulfonylurea herbicide that inhibits the enzyme that catalyzes the biosynthesis of branched-chain amino acids (valine, leucine, and isoleucine) which are essential for plant growth (USDA-APHIS, 2015; USDA-FS, 2004). Glyphosate is non-selective post-emergent systemic herbicide that works by inhibiting essential aromatic amino acids important to plant growth (USDA-FS. 2011c). Glyphosate has a variety of agricultural and non-agricultural uses. Aminopyralid is a systemic selective carboxlic acid herbicide that affects plant growth regulators, or auxins, and has multiple non-agricultural uses. (USDA-FS, 2007).

Insecticide Treatments

The program will use backpack-mounted or ground vehicles to apply dinotefuran or imidacloprid to clusters of *A. altissima* host trees. No aerial applications are proposed. Allowable application, protective equipment, exclusion, dosage, and entry restrictions will follow the label instructions of the insecticide specified. Only licensed applicators or persons working under the supervision of a licensed applicator shall apply insecticides. Dinotefuran or imidacloprid would be used in conjunction with tree removal and banding which are the two other primary non-chemical treatment options. The use of dinotefuran or imidacloprid would only occur through landowner consent.

Dinotefuran/Imidacloprid

Dinotefuran and imidacloprid are systemic neonicotinoid insecticides that are taken up by the root system, foliage, or through the bark and translocated upward throughout the plant. Their mode of action involves disruption of an insect's central nervous system by binding to the post-synaptic nicotinic acetylcholine receptors, thereby competing with the natural neurotransmitter acetylcholine (Simon-Delso et al., 2015). This long-lasting receptor binding has delayed lethal effects such that repeated or chronic exposure can lead to cumulative effects over time (Simon-Delso et al., 2015). Insects must feed on the Tree-of-Heaven to be exposed to a dose which kills them, but the presence of the chemicals only within the plant simultaneously minimizes exposure of non-target organisms (PDA, 2017).

The SLF program will apply either dinotefuran through a basal trunk spray or imidacloprid through trunk injection to approximately 10 trap trees at a given site. Trap trees would be created by leaving a number of live male *A. altissima* (generally 10 inches in diameter at breast height (dbh)) on a property after host tree reduction. Removal of most potential hosts in an area means that when the late instar and adult SLF start searching for *A. altissima* to feed on, their only nearby option is one of the insecticide-treated trap trees (PA DOA, 2017). Treatments will wet the bark just to the point of saturation and avoid run off of the chemicals into adjacent soil. Dinotefuran treatments will not occur when the tree bark is wet, during rainfall, or if rain is expected within 12 hours after application. Currently only one application of the pesticide of 0.54 pounds active ingredient (lbs. a.i.) per acre will occur at a treatment site per year. A Section 24 (c) Special Local Needs registration that will allow an increase in the application rate may be used to increase efficacy, if needed in the future. A similar registration was obtained in Pennsylvania for the SLF program for use on trap trees. The program will not apply dinotefuran when trees are dormant, flowering, under drought stress, or while not actively taking up water from the soil.

Another insecticide option to treat trap trees as part of the SLF control program would be the use of imidacloprid. There are several different imidacloprid formulations available for trunk, soil, seed, and foliar applications. In the SLF control program imidacloprid would be applied through trunk injection at the base of the tree, which is then translocated upward (USDA APHIS, 2015). These application methods were previously used in the ALB eradication programs and are incorporated by reference (USDA APHIS, 2015).

The program intends to use pesticide application equipment mounted on backpacks or ground vehicles, and does not plan any aerial applications of insecticides. Allowable application, protective equipment, exclusion, dosage, and entry restrictions will follow the label instructions for the specific insecticide. Applications of insecticides would occur only with landowner consent.

III. Affected Environment

SLF is native to China and Vietnam, although initially described in 1845 from collected insect specimens in the British Museum (Wolgemuth et al., 2016). SLF is considered an invasive species in Japan, and in South Korea where it was first detected in 2004 (PDA, 2018). On September 22, 2014, the PDA in cooperation with the Pennsylvania Game Commission, confirmed the presence of SLF in Berks County, Pennsylvania, which was the first detection of this non-native species in the United States (PDA, 2018). Based on the number of U.S. detections since that date, it is readily apparent that SLF is an invasive pest within this county.

This chapter considers the baseline conditions of the affected environment that could be impacted by continued SLF outbreaks and control activities. The Mid-Atlantic region is considered representative of where new detections are most likely to occur. This section of the EA considers the Mid-Atlantic region (typically including Delaware, Maryland, New Jersey, Pennsylvania, Virginia, and West Virginia) within the context of areas with suitable habitat for SLF within the country. For this EA, the choice of states is expanded to include all of Connecticut, New York, and North Carolina because aspects of their water drainage and climate (Greene et al., 2005) may create suitable SLF habitat in addition to states traditionally considered as the Mid-Atlantic region. USDA-APHIS uses this information as the basis to evaluate potential impacts of the program.

The alternatives in this EA include the same provisions as in the Alternatives examined in the 2018 SLF Eradication Program EAs for Pennsylvania and Virginia that are incorporated by reference. USDA-APHIS activities would remain focused on individual outbreaks as they are detected regardless of whether they occur on private or public lands. This is because potential hosts occur throughout the country and exploit a wide range of land, water, and air resources. APHIS does not expect any natural or human-mediated dispersion to occur more than 200 miles from the current positive detections. If SLF detection beyond the Mid-Atlantic region occurs, the program will consider if control can no longer be considered possible. While control activities have the potential to impact this affected environment, the presence of invasive, uncontrolled SLF populations will impact those features over time.

A. Suitable Habitat

Suitable SLF habitat occurs when an area contains both hosts that support SLF life stages, and a climate that matches the environmental parameters necessary for SLF growth and reproduction. The hosts provide food, shelter, and egg laying sites; the climatic conditions in the new area are the same or similar to areas where SLF adapted to survive over time. SLF changes hosts as it ages through its developmental stages (PDA, 2018). Nymphs feed on a wide range of plant species, while adults prefer to feed and lay eggs on Tree-of-Heaven. Table 1 provides a list of some SLF hosts (Dara et al., 2015). A global prediction of SLF potential distribution is in Figure 1 (Jung et al., 2017). Figure 2 depicts the combined distribution of four hosts (*Acer rubrum*, *Ailanthus altissima*, *Vitis vinifera*, and *Parthenocissus quinquefolia* (USDA-NRCS, 2018)) that support multiple life stages of SLF, and therefore are highly likely to provide suitable habitat.

Table 1. SLF hosts

Host Plant[1]	**Common Name (Origin[2])**	**Family**	**SLF Life Stage or Activity**
Acer palmatum Thunb.	Japanese Maple (I)	Aceraceae	Feeding
Acer rubrum L.	Red maple (N)	Aceraceae	Adult; feeding, egg laying
Acer saccharum L.	Silver Maple (N)	Aceraceae	Feeding
Ailanthus altissima (Mill.) Swingle[3]	Tree-of-Heaven (I)	Simaroubaceae	Adult, nymph; feeding, egg laying
Aralia elata (Miq.) Seem.[3]	Japanese angelica tree (I)	Araliaceae	Nymph
Arctium lappa L.	Greater Burdock (I)	Compositae	Nymph; feeding
Fagus grandifolia Ehrh.	American beech (N)	Fagaceae	Adult; egg laying
Liriodendron tulipifera L.	Tuliptree (N)	Magnoliaceae	Adult; egg laying
Magnolia kobus D.C.	Kobus magnolia (I)	Magnoliaceae	Nymph; feeding
Malus spp. Mill.	Apple (I, N)	Rosaceae	Feeding
Morus alba L.	White Mulberry (I)	Moraceae	Nymph; feeding
Parthenocissus quinquefolia (L.) Planch.	Virginia Creeper (N)	Vitaceae	Adult, nymph; feeding
Platanus occidentalis L.	American sycamore (N)	Platanaceae	Adult; egg laying
Populus alba L.	White Poplar (I)	Saliaceae	Egg laying
Prunus serotina Ehrh.	Black cherry (N)	Rosaceae	Adult; egg laying
Quercus acutissima Carruthers	Sawtooth oak (I)	Fagaceae	Unknown
Quercus spp. L.	Oak (I, N)	Fagaceae	Adult; egg laying on some species
Robinia pseudoacacia L.	Black Locust (N)	Fabaceae	Feeding
Rosa multiflora Thunb.[3]	Multiflora Rose (I)	Rosaceae	Nymph; feeding
Salix spp. L.	Willow (I, N)	Saliaceae	Adult; feeding

Table 1. SLF hosts			
Host Plant[1]	**Common Name (Origin[2])**	**Family**	**SLF Life Stage or Activity**
Sorbaria sorbifolia (L.) A. Braun	False spiraea (I)	Rosaceae	Nymph; feeding
Syringa vulgaris L.	Common Lilac (I)	Oleaceae	Egg laying
Styrax japonicus Siebold & Zucc.	Japanese snowbell (I)	Styracaceae	Adult, nymph; feeding
Vitis vinifera L.	Wine Grape (I)	Vitaceae	Adult, nymph; feeding, egg laying
Zelkova serrata (Thunb.) Makino	Japanese Zelkova (I)	Ulmaceae	Egg laying

[1] Hosts selected from Dara et al., 2015.
[2] Origins are I = Introduced, N = Native
[3] Considered as invasive by the PA DCNR, 2017.

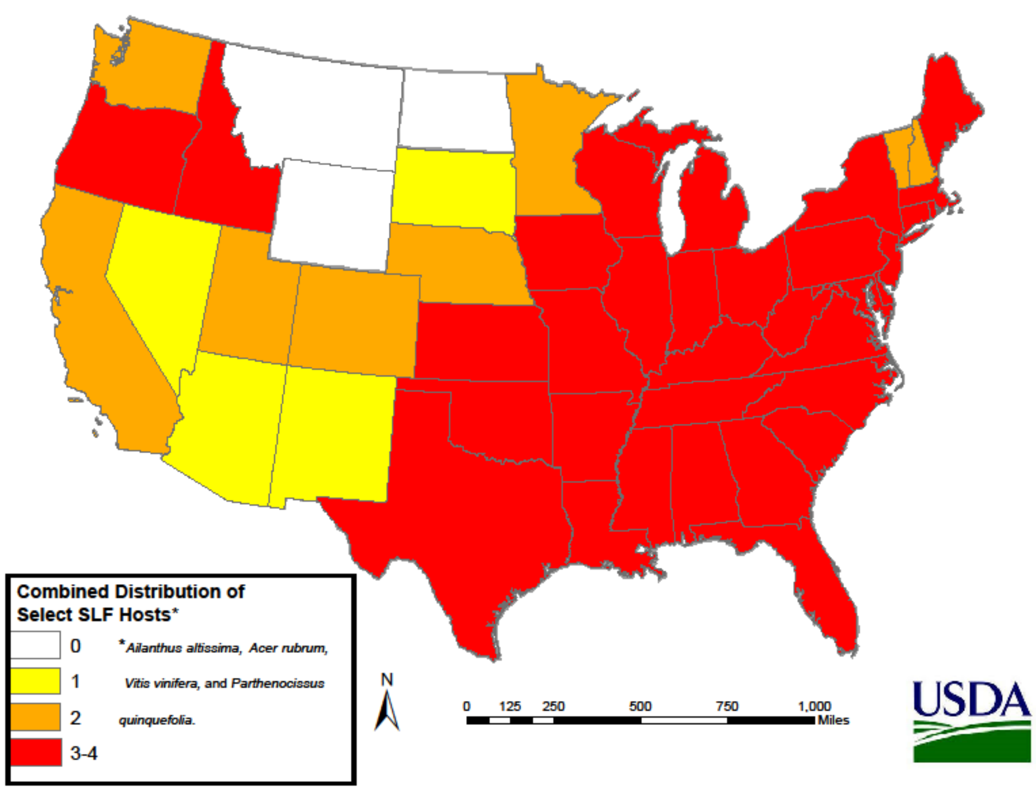

Figure 2. Combined Distribution of Select SLF Hosts. Distribution of Select SLF Hosts. Hosts include *Ailanthus altissima*, *Acer rubrum*, *Vitis vinifera*, and *Parthenocissus quinquefolia* (USDA-NRCS, 2018).

Hosts of SLF grow in a wide range of soils (dry to medium moisture), shade conditions (full sun to part shade), and in the presence of urban pollutants (Missouri Botanical Garden, 2018). Red maple tends to grow in moist, slightly acid conditions, while grape hosts grow best in deep, loamy, humus-rich, medium moisture, well-drained soils (Missouri Botanical Garden, 2018). The combined conditions favorable to SLF hosts indicates plants growing in a wide range of soil types and shade conditions could become infested by SLF where ever they occur. The combination of favorable climate and presence of hosts allows the inference that the Mid-Atlantic region of the United States is highly likely to support the establishment of SLF populations.

In addition to agriculturally important and native tree species, many SLF hosts are recognized as invasive plants that are highly likely to establish in a variety of conditions, including highly disturbed or high human-density developed areas (see table 1). SLF damage to hosts includes release of sap down the exterior of tree trunks (Dara et al., 2015). As the tree weakens, this sap serves as a food source for fungi that may increase the decay rate leading to tree death. SLF's broad host range suggests that any potential for biological control of these invasive plants using SLF must remain counterbalanced against the need to protect agriculturally important tree fruit crops.

B. Agriculture in the Mid-Atlantic Region

Table 2 identifies the wide variety of agricultural production occurring throughout the Mid-Atlantic region (USDA-NASS, 2014), and this includes potential SLF host plants, such as stonefruit and grape crops. Although livestock are not a resource USDA-APHIS expects to experience impacts related to either SLF spread or control efforts because they are unlikely to rely on SLF hosts as food sources, table 2 includes livestock information to aid readers in making comparisons.

Table 2. Select agricultural statistics in the affected area[1]

Jurisdiction	Number of Farms	Acreage of Farms	Market Value of Agricultural Products Sold ($1000)	Major Agricultural Commodities[2]
Connecticut	5,977	436,539	550,620	Dairy, Turkeys, Cattle and calves
Delaware	2,451	508,652	1,274,014	Broilers, Corn, Soybeans
District of Columbia	NA[3]	39,290	NA	NA
Maryland	12,256	2,030,745	2,271,397	Broilers, Corn, Soybeans
New Jersey	9,071	715,057	1,006,936	Tomatoes, Blueberries, Apples
New York	35,537	7,183,576	5,415,125	Dairy, Apples, Corn

North Carolina	50,218	8,414,756	12,588,142	Broilers, Hogs, Turkeys
Pennsylvania	59,309	7,704,444	7,400,781	Dairy, Cattle and calves, Mushrooms
Virginia	46,030	8,302,444	3,753,287	Broilers, Cattle and calves, Turkeys
West Virginia	21,489	3,606,674	806,775	Cattle and calves, Broilers, Turkeys
United States	2,109,303	914,527,657	394,644,481	

[1] Data is from the 2012 Census of Agriculture (USDA-NASS, 2014)
[2] Based on 2016 Commodity estimates reported on March 8, 2018 in USDA-Economic Research Service State Fact Sheets at https://www.ers.usda.gov/data-products/state-fact-sheets/
[3] Data is not available.

Production of fruit in the Mid-Atlantic region is an important component of each State's agricultural productivity, even though the total may be a small proportion of U.S. productivity. For example, 2017 production of tart cherries in New York was 4,500 tons, while the U.S. total was 119,100 tons (https://www.nass.usda.gov/Data_and_Statistics/index.php). Grape and peach production is summarized in table 3.

Table 3. Summary of 2017 Mid-Atlantic Grape and Peach Production

Jurisdiction	**Commodity**[1]		
	Grapes (tons)	**Grapes (Acres bearing)**	**Peaches (tons)**
Connecticut	NA[2]	431	NA
Delaware	NA	NA	3,900
Maryland	NA	528	NA
New Jersey	NA	791	24,000
New York	175,000	36,919	7,000
North Carolina	7,000	2,685	4,200
Pennsylvania	91,000	11,779	19,000
Virginia	9,000	3,733	6,000
West Virginia	NA	215	6,000
United States	7,505,300	NA	735,200

[1] Data is from https://www.nass.usda.gov/Data_and_Statistics/index.php
[2] NA = data is not available; data for the District of Columbia is not available

This information shows the wide diversity of agriculture in the Mid-Atlantic region, and the closely allied natural resources near farm environments that could become affected by SLF or control activities. In general, vegetation types vary based on natural site conditions and changes that occur as people clear land for development and agriculture (Yesilonis et al., 2016). In any given year, the affected environment is likely to form a discontinuous patchwork of farms and wooded areas. USDA-APHIS is not asserting all farms are alike, or that regional and local variations in agricultural production do not exist and will not be important. Instead, by focusing on the common features in the most likely area to be affected, USDA-APHIS is trying to increase the potential for preparedness throughout the region. USDA-APHIS anticipates discussions will occur with individual landowners and state and local officials as the need arises to accommodate the specific resources during SLF outbreaks.

Urban, residential, and industrial areas occur throughout the region (see table 4). Areas with extensive human development, such as cities and university campuses, may have potential SLF hosts planted as part of the urban environment. For example, the Philadelphia port complex handles the largest volume of international shipping freight on the East Coast of the country. Close proximity to local parks, such as Fairmount Park in the City of Philadelphia, suggests escaping pests that hitchhike in imported commodities may find suitable host plants. SLF uses inanimate materials for egg laying (such as stones, fence-posts, and outdoor equipment) which would allow urban areas to add to the risk of SLF dissemination (Dara et al., 2015).

Table 4. Select characteristics of the affected area[1]

Jurisdiction	**Population Census**	**Land area in square miles**	**Population per square mile**	**Major Cities**[2]
Connecticut	3,588,184	4,842.36	738.1	Bridgeport, New Haven, Stamford
Delaware	897,934	1,948.54	460.8	Wilmington, Newark, Dover
District of Columbia	601,723	61.05	9,856.5	Washington, D.C.
Maryland	5,773,552	9,707.24	594.8	Baltimore, Bethesda, Columbia
New Jersey	8,791,894	7,354.22	1,195.5	Newark, Jersey City, Paterson
New York	19,378,102	47,126.40	411.2	New York City, Buffalo, Rochester
North Carolina	9,535,483	48,617.91	196.1	Charlotte, Raleigh, Greensboro
Pennsylvania	12,702,379	44,742.70	283.9	Philadelphia, Pittsburgh, Allentown
Virginia	8,001,024	39,490.09	202.6	Virginia Beach, Norfolk, Chesapeake
West Virginia	1,852,994	24,038.21	77.1	Charleston, Huntington, Morgantown
United States	308,745,538	3,531,905.43	87.4	New York City, Los Angeles, Chicago

[1] Based on 2010 data (U.S. Census Bureau, 2017).
[2] Based on population estimates at http://www.citypopulation.de

C. Land, Air, and Water Characteristics of the Mid-Atlantic Region

The mid-Atlantic's predominant physiographic characteristic is the Appalachian Mountains that separate the eastern seaboard from the mid-West of the country. There are six major geologic provinces in the mid-Atlantic region: (1) Coastal

Plain, (2) Piedmont, (3) Blue Ridge, (4) Ridge and Valley, (5) Appalachian Plateau, and (6) the Central Lowlands. Forming the boundary between land and ocean, the Coastal Plain stretches 2,200 miles along the edge of the continent. At the Virginia-North Carolina border, this province is about 120 miles wide, and narrows sharply until it disappears in central New Jersey where Piedmont extends to the ocean shore. The Central Lowlands occur only where Pennsylvania borders Lake Erie (Rappole, 2007). The parallel series of ridges and valleys that characterize the Piedmont Province generally run from the southwest to northeast. The Piedmont extends westward from the Coastal Plain to the base of Blue Ridge Mountains in Maryland, southern Pennsylvania, and Virginia. Inland of the Piedmont is the Blue Ridge that runs about 550 miles long from Georgia to Pennsylvania. North and west of the Blue Ridge is the Ridge and Valley system that is only about 80 miles wide and consists of higher ridges and deeper valleys. The Appalachian Plateau includes most of western Pennsylvania and West Virginia (Rappole, 2007).

Typically recognized habitats in the mid-Atlantic are: (1) Coastal Waters and Shoreline, (2) Freshwater Wetland, (3) Grassland, (4) Broadleaf Deciduous and Mixed Forest, (5) Northern Mixed Hardwood, (6) Highland Coniferous Forest, (7) Southern Floodplain Forest, and (8) Agricultural and Residential (Rappole, 2007). Forest fragmentation and forest edge habitat are common in the region. Over time, the process of deforestation converted land-cover from forestry to agriculture and urban uses, including an extensive system of roads. The slope of the land determines the amount and timing of sunlight, along with the soil moisture, and consequent plant communities in any area. The slope of the land influences the nitrogen and phosphorus export to streams as well as the soil loss associated with agriculture (Jones et al., 1997). Soil erosion from removal of Tree-of-Heaven has the potential to impact waters in the affected environment where ever tree removal occurs, although there is reduced potential to impact erosion rates when root balls remain and slowly decay over time (see discussion in Environmental Consequences).

The Koppen-Geiger climate classification recognizes this region as predominantly "Cfa" (Humid subtropical) and "Dfb" (Warm-summer humid continental), with small areas between them as either "Cfb" (Oceanic) or "Dfa" (Hot-summer humid continental) (Kottek et al., 2006). These climate areas do not have a significant differences in precipitation among the seasons, and they all exhibit at least four months averaging above 10C (Pidwirny, 2006). The Cfa humid subtropical climate has hot, muggy summers and frequent thunderstorms. The coldest month averages above 0C; and at least one month's average temperature is above 22C. Precipitation during the mild winters comes from mid-latitude cyclones. Winters in the Dfb warm-summer humid continental climate are severe with snowstorms, strong winds, and bitter cold from Arctic air masses. The coldest month averages below 0C, and the average temperatures for all months are below 22C. The Cfb temperate oceanic climate has a coldest month averaging above 0C, and the average temperatures for all months are below 22C. The Dfa hot-summer humid continental climate has a coldest month averaging below 0C, and at least one month's average temperature is above 22C (Pidwirny, 2006). Others recognize four major climatic zones in the mid-Atlantic as Austral, Carolinian, Alleghenian, and Canadian (Rappole, 2007).

These features create favorable environments for a diversity of land uses ranging from agriculture and natural areas to urban and industrial land use. Land use in the region changes over time, as exemplified by reductions in agricultural land enabling forest recovery from 1973 to 2000, and subsequent forest declines caused by urban growth and development (Drummond and Loveland, 2010). Land use changes also affect the populations and distributions of wildlife (Leonard et al., 2017).

Karst density mapping shows many areas where sinkholes, surface depressions, and caves may be associated with direct recharge zones to local and regional aquifers, making these areas vulnerable to groundwater contamination (Weary, 2005). Naturally occurring dying or dead trees impact erosion in localized areas, which influences downstream water quality.

As trees die, there is a reduced capacity to recharge oxygen in the atmosphere. If the vegetation is replaced, then this type of short-term, indirect effect on air quality would be unnoticeable. The release of chemical agents into the air is another potential source of impact to air quality. In a larger context, impacts to air quality influence human health, and could lead to changes in the climate. For these reasons, it is necessary to consider the baseline air quality in the region.

The Clean Air Act (CAA) (42 U.S.C. §§ 7401 et seq.) is the primary Federal legislation that addresses air quality (regulations are at 42 CFR parts 7401-7671). In any given region or area of the United States, air quality is measured by the concentration of pollutants in the atmosphere, and is influenced by surface topography and prevailing meteorological conditions. The U.S. Environmental Protection Agency (U.S. EPA) established National Ambient Air Quality Standards (numerical concentration-based standards) for six criteria pollutants that impact human health and the environment (40 CFR part 50). These pollutants are common and accumulate in the atmosphere as a result of natural processes and normal levels of human activity. They include carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), sulfur dioxide (SO_2), small particulate matter, and lead (Pb) (U.S. EPA, 2018a).

Evaluation of the potential for impacts from these types of pollutants uses an air quality index (AQI) which is a measurement of the level of pollutants in the atmosphere for a given area. An AQI above 100 indicates that air quality conditions exceed health standards, while values below 100 indicate pollutant levels are below air quality standards. An AQI that exceeds 100 suggests that air quality may be unhealthy for certain sensitive groups of people, with more groups being impacted as the AQI number increases (U.S. EPA, 2018a).

There is a regional pattern of increasing nitrate deposition from south-to-north that may reflect prevailing winds carrying air pollutants from other regions (Jones et al., 1997). At higher elevations, the estimated nitrate and sulfate wet deposition are greater because topographic features influence the deposition of rain and fog water droplets that carry dissolved sulfates and nitrates. Surface ozone levels, on the other hand, follow the distribution of urban areas rather than topography (Jones et al., 1997).

In 2017, cities in Connecticut, Delaware, the District of Columbia, Maryland, New Jersey, New York, North Carolina, and Virginia generally reported four or fewer days with Unhealthy or Very Unhealthy Air Quality, with particulate matter 2.5 and ozone being the likely pollutants (https://www.epa.gov/outdoor-air-quality-data/air-quality-index-report). Notable exceptions include Unhealthy Air Quality reports on: (a) six days in Cumberland MD/WV likely due to sulfur dioxide, (b) three days in Asheville NC likely due to sulfur dioxide, particulate matter 2.5 and ozone, and (c) 27 days in Blacksburg-Christiansburg-Radford due to sulfur dioxide and ozone. Pennsylvania cities reported Unhealthy Air Quality for two or fewer days each at New York-Newark-Jersey City, Philadelphia-Camden-Wilmington, and Pittsburgh with particulate matter 2.5, sulfur dioxide, and ozone being the likely pollutants (U.S. EPA, 2018b).

Long-range transport of air pollutants downwind of emission sources is a contributing factor for ozone pollution (Liao et al., 2014). Generally, reductions of nitrogen oxide emissions are an effective ozone control measure, but where volatile-organic compounds are limited, reducing nitrogen oxide emissions can actually increase ozone. Air quality modeling shows this can occur in four major-city non-attainment areas in the Mid-Atlantic region (Baltimore, Pittsburgh-Beaver Valley, Philadelphia-Wilmington-Atlantic City, and Washington, D.C.). The modeling found that the overall ozone benefits associated with decreasing nitrogen oxides outweighed the harm from a slight increase in ozone (Liao et al., 2014).

Streams and rivers carry water, and transport sediments, nutrients, and pollutants downstream. Dams are relatively abundant in the region, with the highest densities along the Delaware River and in southeastern Virginia. The Chesapeake Bay is east of the Appalachians, and has estuarine and wetland habitats associated with lowland areas and slowly draining soils. The region's water basins contain numerous lakes, rivers, and streams, many of which have good water quality while others may be impaired by various activities. There are more than 120 named watersheds in the region (Jones et al., 1997); Table 5 lists the water resource sub-regions, and identifies other environmental important areas in the region.

Table 5. Summary of Environmentally Important Areas[1]				
Jurisdiction	**Water Resource Sub-Regions**	**Lakes and/or Scenic Rivers**	**Number of**	
			National Forests	**State Parks**
Connecticut	Lower Hudson-Long Island	First, Second, Third, and Fourth Connecticut Lakes / Eightmile and Farmington Rivers	0	101
Delaware	Delaware-Mid Atlantic Coastal, Upper Chesapeake	White Clay Creek	0	17
District of Columbia	Potomac	None[2]	0	0
Maryland	Delaware-Mid Atlantic Coastal, Potomac, Susquehanna, Upper Chesapeake	None	0	49
New Jersey	Delaware-Mid Atlantic Coastal, Upper Hudson	Delaware, Great Egg Harbor, Maurice, and Musconetcong Rivers	0	31
New York	Delaware-Mid Atlantic Coastal, Richelieu, Susquehanna, Upper Hudson	Lakes Erie, Champlain, St. Francis, Oneida, Seneca, Cayuga, and Georgia / Delaware River	Finger Lakes	188
North Carolina	Chowan-Roanoke, Neuse-Pamlico, Cape Fear, Pee Dee, Edisto-Santee, Ogeechee-Savannah	Lakes Kerr, Mattamuskeet, and Norman / Chattooga, Horsepasture, Lumber, and Kanawha Rivers, Wilson Creek	Cherokee	35
Pennsylvania	Delaware-Mid Atlantic Coastal, Potomac, Susquehanna, Upper Chesapeake	Lake Erie / Allegheny, Clarion, and Delaware Rivers, White Clay Creek	Allegheny	110
Virginia	Lower Chesapeake, Potomac, Upper Chesapeake	Kerr Lake / None	George Washington and Jefferson	41
West Virginia	Potomac	Bluestone River	George Washington and Jefferson, Monongahela	37

[1] Based on information available in Wikipedia.org (March 13, 2018).
[2] None designated by the Federal managing agencies (Army Corps of Engineers, Bureau of Land Management, National Park Service, Forest Service, or Fish & Wildlife Service).

Hydric soils in the Mid-Atlantic region include depressional, fringe, riverine, and slope wetlands, and mineral or organic flats (Vasilas and Vasilas, 2011). Additionally, there are a wide range of problem hydric soils that complicate the identification of wetlands in the region. The preferred habitats for many SLF hosts do not include wetlands.

States are required to report impaired waterways to the U.S. EPA under section 303(d) of the Clean Water Act (CWA) (water quality regulations are at 40 CFR § 130.7(b)) (U.S. EPA 303(d), 2018) (see table 6). States identify all waters where required pollution controls are insufficient to attain water quality standards, and establish priorities for development of total maximum daily loads (TMDLs). Many contaminants naturally occur in ground water, but crop fertilization and domestic septic systems often cause elevated concentrations in ground water. Nitrate is a U.S. EPA-regulated contaminant and its presence above the regulatory limit of 10 mg/L as nitrogen is a potential health risk (Greene et al., 2005). In the Mid-Atlantic region, ground water has a greater than 50-percent probability of contamination with nitrate (exceeding 3 mg/L) in agricultural areas where manure is applied as fertilizer, or in areas overlying carbonate rocks or coarse sand deposits. Ground water in areas with carbonate rocks may have a greater than 50-percent probability of nitrate concentrations exceeding 10 mg/L (Greene et al., 2005). Similarly, minimizing phosphorus from agricultural soils as a nonpoint source of pollution in surface waters and shallow ground waters remains important in reducing surface water eutrophication (Sims et al., 2002).

Table 6. Summary of Impaired Waters by State

Jurisdiction (Report Years for Assessed and Impaired Waters)	Number of Waters on 303(d) List[1]	TMDLs	Leading Causes of Impairment
Connecticut (2016)	287	407	Algal Growth, Nutrients, Polychlorinated Biphenyls
Delaware (2006)	101	581	Nutrients, Pathogens
District of Columbia (2016)	36	434	Pathogens, Polychlorinated Biphenyls
Maryland (2012)	337	840	Mercury, Nutrients, Sediment and Turbidity
New Jersey (2014)	763	665	Mercury, Pathogens, Metals other than Mercury
New York (2014)	611	724	Mercury, Nutrients, Polychlorinated Biphenyls
North Carolina (2016 / 2014)	1,155	13,523	Mercury, Polychlorinated Biphenyls, Algal Growth
Pennsylvania (2006 / 2004)	6,957	7,157	Sediment, Metals other than Mercury, pH/Acidity/ Caustic Conditions
Virginia (2014)	1,391	1,566	Polychlorinated Biphenyls, Mercury, Organic Enrichment / Oxygen Depletion
West Virginia (2014)	1,163	5,344	Mercury, Metals other than Mercury, Pathogens

Table 6. Summary of Impaired Waters by State			
Jurisdiction (Report Years for Assessed and Impaired Waters)	**Number of Waters on 303(d) List[1]**	**TMDLs**	**Leading Causes of Impairment**
[1] Available through searches at https://ofmpub.epa.gov/waters10/attains_nation_cy.control (U.S. EPA, 2018c)			

D. Wildlife Concerns in the Mid-Atlantic Region

On August 2, 2012, USDA-APHIS and the U.S. FWS signed a memorandum of understanding to promote the conservation of migratory bird populations in compliance with Executive Order 13186, "Responsibilities of Federal Agencies to Protect Migratory Birds". All of the states considered in this EA are part of the Atlantic Flyway for migratory birds (U.S. FWS, 2018), and they manage waterfowl hunting / regulations for their jurisdictions. The migratory bird flyways are terrestrial and waterfowl pathways that birds follow to cross habitats (La Sorte et al., 2014). Table 7 summarizes important areas in the region that birds depend on for habitat (Audubon, 2018). While endangered or threatened species inhabit some of these areas, other areas may be recognized for their capacity to support populations of breeding or overwintering bird species, congregations of birds, or serve as a migrant stopover or flyover area.

Table 7. Summary of Important Bird Areas

Jurisdiction	Number of Areas[1]			Number of Counties	Total Acres
	Global	Continental	State		
Connecticut	9	7	19	7	19,550
Delaware	1	3	3	3	287,721
Maryland	6	21	29	21	1,000,178
New Jersey	7	21	92	21	3,808,252
New York	16	56	111	56	7,511,385
North Carolina	32	67	53	67	4,879,672
Pennsylvania	4	61	73	61	1,456,467
Virginia	9	60	8	60	8,585,313
West Virginia	14	19	5	19	9,771,348

[1] From http://www.audubon.org/important-bird-areas (Audubon, 2018).

To date, the potential for wild North American birds to overcome SLF prey defenses and use SLF as a food source (despite distasteful defensive alkaloids and layered behavioral responses) (Kang et al., 2016) is not known. Similarly, the extent of the ability of U.S. native hemipteran populations (*Arilus cristatus* (Linnaeus) and *Apoecilus cynicus* (Say)) to successfully prey on SLF is not yet known (Barringer and Smyers, 2016).

Declines of pollinators and high mortality rates in honey bee colonies remain a major concern since mass die-offs of colonies occurred in 2006–2007 (Seitz et al., 2015). During the 2014-2015 national survey, self-identified causes of overwintering mortality differed by operation size, with smaller backyard beekeepers generally indicating starvation and weak colony in the fall as responsible for colony losses, and commercial beekeepers who emphasized varroa mites (*Varroa destructor*), nosema, and queen failure as causes. Multiple interacting factors drive honey bee colony mortality including parasitization and virus transmission by mites, other parasites and disease, poor nutrition due to changing land use patterns and decreased forage availability, large-scale replacement of nectar and pollen-rich legumes with synthetic fertilizers, and sublethal impacts of pesticides (Seitz et al., 2015).

The diversity of land cover creates a variety of terrestrial and aquatic habitats for other types of wildlife. Many wildlife species are common throughout the region. As changes to the SLF control efforts occur, USDA-APHIS reinitiates consultation with the U.S. Fish and Wildlife Service (FWS) on the proposed program's potential to affect listed species and critical habitat in the program area. Table 8 identifies the federally listed species USDA-APHIS and the FWS previously consulted on for the SLF program.

Table 8. Summary of likely presence of Federally listed species in representative counties in Pennsylvania

Scientific Name	**Common Name**	**Status[1]**	**Counties where the species are present or reported as likely to be present**
Alasmidonta heterodon (Lea)	Dwarf wedgemussel	E	Monroe
Bombus affinis	Rusty-patched bumblebee	E	Extirpated from Pennsylvania
Clemmys muhlenbergii (Schoepff)	Bog (Muhlenberg) turtle	T	Berks, Carbon, Delaware, Lancaster, Lebanon, Lehigh, Montgomery, Monroe, Northampton, Schuylkill
Myotis septentrionalis (Trouessart)	Northern long-eared Bat	T	Berks, Carbon, Delaware, Lancaster, Lebanon, Lehigh, Montgomery, Monroe, Northampton, Schuylkill
Myotis sodalis Miller and G.M. Allen	Indiana bat	E	Berks, Carbon, Delaware, Lancaster, Lebanon, Lehigh, Montgomery, Monroe, Northampton, Schuylkill
Scirpus ancistrochaetus Schuyler	Northeastern bulrush	E	Carbon, Lehigh, Monroe, Schuylkill

[1] Endangered = E; Threatened = T; there are no proposed or candidate species for listing present or reported as likely to be present in Pennsylvania (ECOS, 2017).

This section considered the baseline conditions in the Mid-Atlantic region by focusing on suitable SLF habitat and features in the region where detections are likely to occur in the near future. In general, the region exhibits environmental and agricultural characteristics that are repeated throughout the range, despite local variations associated with altitude and slope. Aspects of water are important because of the potential for removal of Tree-of-Heaven (as a program activity) to contribute to local water quality issues via soil erosion. By removing only above-ground portions of the plants, APHIS will reduce this potential for soil erosion. There is much less potential for pesticide movement into waters, or soil with adhered pesticide residues moving into waters, as discussed in the next section on Environmental Consequences. The counties with Coastal Plain areas intergrade with respect to shared resources that will influence the establishment and spread of SLF.

IV. Environmental Consequences

The types of environmental impacts considered for this EA are the same as in the "Spotted Lanternfly Eradication Program in Berks, Lehigh and Montgomery Counties, Pennsylvania Environmental Assessment" of May 2015 which is incorporated by reference, except that the existing program is considered as a source of cumulative effects for the future. USDA-APHIS finds the environmental analysis still applies, except for the additional chemical exposures that would occur in the additional counties. Under both alternatives, USDA-APHIS anticipates SLF attacks on potential hosts on private and public lands, leading to environmental changes where outbreaks may occur. USDA-APHIS does not expect the range and extent of potential impacts to differ from those analyzed in the original EA for Berks, Lehigh, and Montgomery Counties based on surveys, egg mass scraping, sanitation, tree removal, and tree banding activities.

The types of potential environmental impacts associated with the program's use of pesticides (the insecticide imidacloprid, and herbicides triclopyr, imazapyr, and metsulfuron-methyl) are the same as in the "Asian Longhorned Beetle Eradication Program, Draft Programmatic Environmental Impact Statement – March 2015" which is incorporated by reference (USDA-APHIS, 2015). Based on their chemical similarities, the types of potential environmental impacts associated with the program's use of dinotefuran are expected to be similar to those of imidacloprid. The potential amount or quantity of environmental impacts associated with insecticidal treatment is expected to be very low at any specific site; and negligible overall in comparison to other agricultural uses.

A. No Action

Under the no action alternative, USDA-APHIS funding of control efforts would allow each state to pursue its choice of activities. Other government agencies and private landowners may work to eradicate SLF; however, there would be no cooperative or coordinated efforts among USDA-APHIS and other stakeholders. USDA-APHIS would not deploy regulatory controls, such as establishing quarantines or commodity certification programs.

Without a Federal quarantine, there would be no Federal restriction on the movement of SLF infested plant material. Harvested crops and nursery plants would not be inspected, treated, or certified prior to movement and sale unless the state chose to establish these activities as part of their actions. A USDA-APHIS quarantine would facilitate safeguarding of local fruit stands, mandatory baggage inspection at airports, and judicious use of road patrols and regulatory checks. The lack of Federal quarantine actions associated with this alternative would allow human-mediated transport of SLF in commodities and host plant materials throughout the country.

A lack of a cooperative control efforts would likely allow further SLF spread, which increases the difficulty in achieving successful control. As SLF establishes in new areas, impacts would become widespread over the long-term. Impacts would occur where ever SLF hosts grow, such as urban plantings, orchards, and forested areas. Infested trees weaken over time and may become a fall hazard; they continue to provide habitat for SLF to spread. When hosts die, the environmental impacts associated with tree death or removal will vary with the intensity of SLF infestation at each site.

SLF-host orchard crops and urban trees could sustain damage to the point of needing replanting. Although tree removal in orchards regularly occurs as producers replace less productive trees over time, SLF infestation is likely to increase the rate of tree replacement if existing trees are not treated. It could take many years for regrowth or replanting to reach full productivity. Development of resistant stone fruit tree or grape varieties also would take a long time and incur many costs (Woodcock et al., 2017). In today's economy, less productive orchards are not economically sustainable as agricultural producers (Daane et al., 2018). Private entities are likely to increase their use of pesticides resulting in increased human health risks. Less productive infested trees in urban areas could increase the energy requirements for nearby buildings as reflected in increased use of heating in winter and air-conditioning in summer (Akbari et al., 2001).

In natural ecosystems, reduced growth or the loss of SLF-host trees would create canopy gaps leading to increased establishment of invasive plants, particularly other shade-intolerant vegetation. Ecosystem impacts from SLF infestation are likely to be similar to impacts from other causes of tree mortality, which are known to include changes to forest composition, structure, and microenvironments; alterations to critical ecosystem processes such as nutrient cycling and retention; and increased ecosystem susceptibility to invasion by exotic plants and animals (Orwig, 2002). Historically, outbreaks of introduced pests and pathogens led to shifts in harvesting strategies of host trees (Orwig, 2002). For SLF, the presence of an invasive tree host serving as a reservoir for infestations to agricultural crops poses the greatest risk for agroecosystem functioning. The growth of oak, pine, and walnut trees is likely to be reduced, but the level of tree mortality remains unknown. To date, the invasive growth of Tree-of-Heaven does not appear to be reduced by the presence of SLF.

Stress induced by SLF attacks could predispose hosts to invasion by other pests and infections by pathogens. The effects of natural and manmade stressors to tree populations (e.g., timber harvests, acid rain, weather-related air pollution, pests and diseases) can be additive or synergistic (Hodgson et al., 2017; Woodcock et al., 2017).

SLF outbreaks could shift natural plant succession on an uncultivated premise, and cultivated areas may shift away from host or tree fruit production to remain economically viable. While these types of shifts in land use could cause localized physical and chemical changes to the soil quality, these changes also may increase erosion and decrease water quality. As a pest with the potential to influence land cover, SLF may lead to successionary changes that alter water movement at the local level. Taken together, small changes to water quality and water flow could influence human health and agriculture in the region.

B. Preferred Alternative

USDA's preferred alternative for the proposed SLF program is control using an IPM approach. This alternative combines quarantine and commodity certification with control treatments. This alternative reduces the likelihood of SLF populations establishing in the country, and minimizes impacts to the environment, the public, and program operating costs.

For many pests, control programs rely on well-established species-specific combinations of surveillance, targeted bait sprays, trapping, and biological control methods. SLF presented new biological issues that USDA-APHIS and PDA considered while developing the current control strategy and mitigation methods. The SLF program may include any or all of the methods discussed in the prior SLF EA in combination with additional chemicals as discussed in the ALB EIS (USDA-APHIS, 2015).

Program removal of select trees would impact fewer trees than when all hosts have the potential to become infested over time. Tree removal under the preferred alternative would occur faster than allowing SLF damage to accrue over time. Under the preferred alternative, urban areas are less likely to serve as refugia for orchard infestations.

In general, impacts of tree removal include increased erosion, alterations to the vegetative understory and soil microflora, soil compaction, compression of vegetation, reduced local carbon sequestration (Foote et al., 2015; Li et al., 2004), and the potential for introduction of weeds on equipment. Impacts of tree removal can be reduced by use of best management practices (Aust and Blinn, 2004; Warrington et al., 2017). Over time, natural succession and intentional planting would offset carbon dioxide release into the atmosphere from the removal of trees (Mikkelson et al., 2013).

Changes in canopy cover, interception and evapotranspiration due to the removal of trees may alter stream flow and soil moisture (Mikkelson et al., 2013), while tree mortality or removal adjacent to aquatic resources could reduce shading and alter water temperatures. Degradation of water quality can negatively affect aquatic organisms through direct or indirect impacts to fish, aquatic insects, and crustaceans (Englert et al., 2017; Morrissey et al., 2015).

The potential for these types of impacts depends on the dominance of the host trees in the urban or forested areas. Urban areas would experience incrementally minor impacts to environmental quality in comparison to other activities, such as residential and business development that increases impervious surfaces and allows transport of a variety of pollutants to surface and ground water. In forested areas, impacts associated with tree removal vary with site-specific conditions and other activities occurring within the watershed. The program's removal of trees would result in temporary loss of wildlife habitat that resprouting and natural succession will restore over time. Tree-of-Heaven in forested areas typically occur in small patches as canopy trees but can also occupy the understory. Any potential impacts to terrestrial and aquatic systems would be localized and transient since they are an invasive species and not considered a dominant tree species over large forested areas.

As the areas under regulatory control (quarantine) expand, more personnel (APHIS, state, and volunteers) would become involved in the cooperative control efforts. Expanding areas under quarantine impacts additional businesses and residents who handle regulated materials, or have properties affected by the control efforts. The next two sections summarize pertinent aspects as related to increased pesticide use in larger areas.

Herbicide Considerations

Herbicide application directly on stump surfaces, and according to label instructions, minimizes damage to nearby vegetation from drift or runoff. Applications are made by hand to sprouts using a backpack sprayer or to cut stumps using injection, hack and squirt, or other hand applied methods directly to the stump. This is an effective means of control for *A. altissima* when applied between June and August. Impacts to human health and the environment from the proposed use of herbicides are anticipated to be incrementally minor in comparison to existing agricultural and non-agricultural (e.g., right-of-way and forestry) uses. The U.S. Forest Service (USDA-FS) uses triclopyr and, to a lesser extent, imazapyr in many of its invasive weed control programs (USDA-FS, 2011a). The proposed use of herbicides in the SLF Control Program is not expected to contribute significantly to the overall use of herbicides by other entities.

USDA-APHIS evaluated the potential human health and ecological risks from the proposed use of triclopyr, imazapyr, and metsulfuron-methyl for the ALB Eradication Program, and finds the same risk types and exposures would apply to the SLF program. Risks would also be low to human health and the environment for glyphosate and aminopyralid based on risk assessments prepared by the USDA-FS that have similar use patterns to those proposed for the SLF program (USDA-FS 2007; 2011b).

The risks to human health are expected to be negligible based on limited exposure from the proposed use pattern of these herbicides (hand painting and backpack spraying). The risk of exposure is greatest for workers who will apply the product.

The potential exposure for workers is low with proper use of required personal protective equipment. The risk of exposure to the general public is also minimal. Risks were quantified for workers and the general public and shown to be low even in extreme exposure scenarios such as accidental spills. Any activities on private property related to SLF, including *A. altissima* removal, will only occur with landowner permission.

The risks posed by herbicide use to non-target fish and wildlife also are minimal. The proposed use pattern reduces potential exposure to most non-target fish and wildlife. Wild mammals and birds are at very low risk from herbicide applications due to the low toxicity of all the proposed herbicides and the lack of anticipated effects to food sources that they use. Aquatic organisms are also at low risk based on the favorable toxicity profile and expected low residues that could occur in aquatic environments from the proposed applications. There would be some risk to non-target terrestrial plants from herbicide treatments. However, the potential for effects would be restricted to areas immediately adjacent to any application.

Insecticide Considerations

USDA-APHIS evaluated the potential human health and ecological risks of the proposed use of imidacloprid for the ALB Eradication Program, and finds the same risk types and exposures would apply to the SLF program. The potential impacts reported in Appendix F of the Draft ALB EIS are incorporated by reference.

Insecticide use will only occur on a small number of Tree-of-Heaven trap trees in a given area. Commodities for human consumption will not be harvested from dosed trees, consequently, there will be no dietary risk to humans. The risks to human health from these chemicals are expected to be negligible based on limited exposures from the proposed use pattern of trunk and soil injection. The risk of exposure would be greatest for the workers applying the product, but properties of the formulation and the requirement to use protective equipment result in a low potential for worker exposure.

Even though insecticidal concentrations are expected to be higher during this application than during broadcast uses, the total amount per acre will be lower due to the targeted application methodology.

Dinotefuran has low to moderate acute and chronic toxicity to nontarget wildlife, such as mammals and birds. Direct risk to nontarget wildlife is not expected based on conservative estimates of exposure and the available toxicity data. An increase in the acreage containing treated hosts does not change the toxicity; however, animals migrating through counties with treated acreage have the potential for more exposure incidents.

Indirect impacts to wildlife populations through the loss of invertebrate prey are also not expected to be significant because only sensitive terrestrial invertebrates that feed on treated trees will be impacted while other insects remain available as prey items. An increase in the acreage containing treated hosts does not change this balance; it only increases the acreage where this may occur. Although it has not been observed, there is a potential for migrating or foraging animals to alter their patterns or expand their ranges if invertebrate prey becomes limiting in their current areas.

The proposed program's use pattern will minimize potential impacts to honey bees, and other sensitive terrestrial invertebrates, based on the use of basal trunk sprays that minimize drift. There will be no pesticide applications to seeds during planting operations, so dust is not a source of bee exposure. The program will avoid applying insecticides when foliage is in bloom to decrease the potential for effects to beneficial insects associated with pollination.

Neonicotinoid insecticide toxicity is high for honey bees yet there is uncertainty regarding the impacts of residues from this class of systemic insecticides in pollen and nectar. The main dinotefuran metabolites in plants[4] are toxic to bees, and exhibit higher mobility and durability (Li et al., 2017). The main imidacloprid metabolite in plants[5] is also toxic to honey bees and mice, while another metabolite (6-chloronicotinic acid) may induce plant defenses against plant disease or drought (Simon-Delso et al., 2015). Studies measuring pollen and nectar residues in crops with imidacloprid show sublethal effects occurring above residues measured in the field. Sublethal effects from low-level chronic exposures to neonicotinoid pesticides in bee species vary with the species' sensitivity, life cycle, foraging behaviors, and colony development (Arce et al., 2017; Li et al., 2016); however, there are significant knowledge gaps concerning the impacts of neonicotinoids on bees (Lundin et al., 2015). Chronic exposure to imidacloprid at the higher range of field doses in pollen of certain treated crops could cause negative impacts on honey bee colony health and reduced overwintering success (Dively et al., 2015). Recent data suggests bees reduce total food consumption even though they cannot taste neonicotinoids in nectar, and chronic neonicotinoid exposures may impair olfactory learning and memory in honey bees leading to reductions in foraging efficiency (Kessler et al., 2015). Toxicological interactions with dinotefuran indicate risk assessments based on individual neonicotinoid pesticides may underestimate the realistic toxicity based on the observation of synergistic and additive effects (Liu et al., 2017). In general, declines in bees are due to chronic multiple interacting stressors that may act synergistically (David et al., 2016; Goulson et al., 2017; Lundin et al., 2015).

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[4] These include: 1-methyl-2-nitroguanidine (MNG), 1-methyl-3-(tetrahydro-3-furyl methyl)urea (UF), and 1-methyl-3-(tetrahydro-3-furylmethyl)guanidine (DN). In the United States, residues of dinotefuran are the sum of dinotefuran, UF, and DN (Li et al., 2017).
[5] Desnitro-imidacloprid (IMI-NH)

Neonicotinoid insecticides exhibit high water solubility and low soil adsorption, leading to movement of these chemicals in runoff and long half-lives in soil and water, even though individual metabolites may be shorter-lived and the presence of decreased pH and low turbidity can reduce chemical persistence (Morrissey et al., 2015). For example, dinotefuran is very sensitive to photolysis, and its degradates are less toxic to aquatic organisms than imidacloprid (USDA-FS, 2004; USDA-APHIS, 2015). In addition to agricultural factors such as the application rate, non-agricultural factors that affect soil persistence – and therefore the likelihood of movement into waters – include temperature, presence of plant cover, soil type, and organic content at the site. There are reports of measurable and ecotoxicologically relevant concentrations of imidacloprid stable in water for more than one year (Morrissey et al., 2015). The acute toxicity of neonicotinoids to mammals, fish, and birds generally is lower than other insecticides, but extremely low water concentrations (below 1µg/L) can induce short-term lethal effects to some sensitive crustaceans (Branchiopoda) and insects, such as mayflies (Ephemeroptera), caddisflies (Trichoptera), and midges (Diptera) (Morrissey et al., 2015).

Drift of these chemicals into sensitive aquatic habitats and impacts to air quality are not expected based on the direct application to tree trunks which minimizes the potential for off-site transport. There may be an environmentally important concentration of neonicotinoids remaining in the leaves that drop in the autumn, are carried to water resources, and serve as a source of chemical leachate from the leaves (exposure) or are consumed (dietary) by aquatic organisms such as detritivore macroinvertebrates (shredders) (Englert et al., 2017). The program's treatment of only trap trees effectively reduces the number of insecticide-bearing leaves that could follow this pathway.

Exposure and risk to aquatic organisms will be minimized by adherence to label requirements regarding applications near water. Risk is expected to be minimal to fish, with an increased risk to some sensitive aquatic invertebrates in very shallow water bodies immediately adjacent to treated trees. Ecological risks for terrestrial and aquatic non-target organisms also are expected to be low based on the method of application, toxicity, and environmental fate of these insecticides. The different species of host plants are not likely to vary these risks because they arise from the chemical properties of the dinotefuran or imidacloprid (U.S. EPA, 2004; USDA-FS, 2009).

There is some risk to sensitive terrestrial invertebrates that consume vegetation from treated trees (or inhabit the soil where soil injection occurs). Terrestrial invertebrate populations may consume a wide range of host plants, which would limit the percentage of exposure through their diet. There are different terrestrial invertebrate populations at each location, and at the present time, areas that might be treated for ALB and SLF do not overlap. Risks to terrestrial invertebrates, including pollinators, are expected to be negligible based on available data collected from ALB-specific applications of imidacloprid. Impacts to susceptible insects that feed on treated trees are expected, but due to the method of application and the treatment of specific host trees, the effects are expected to be localized and not widespread.

At one time, the insect called the Cynthia Moth (*Samia cynthia* (Drury) Lepidoptera: Saturniidae) or ailanthus silk moth, was considered as a potential biological control for the Tree-of-Heaven because its larval stage can quickly defoliate trees (Hartman et al., 2000). However, its population is in decline reportedly due to due to parasitoids, pollution, and increasing habitat for avian predators of the moth (Thompson, 2008). The impact of dinotefuran within tree tissues while larvae feed (generally June to July, according to https://www.butterfliesandmoths.org/species/Samia-cynthia) is not known.

Other Environmental Considerations

In this section, the “other areas of concern” reflect legislatively mandated inquiries, such as the Endangered Species Act of 1973, as amended (ESA, P.L. 93-205; 16 U.S.C. §§ 1531-1544), Migratory Bird Treaty Act (16 U.S.C. §§ 703-712; 50 CFR § 21), National Historic Preservation Act of 1966, as amended (P.L. 89-665; 16 U.S.C. §§ 470 et seq.), and pertinent Executive Orders. USDA-APHIS complies with all applicable regulations, and the analyses in prior sections meet various requirements from the Clean Air Act of 1963, as amended (P.L. 88-206, 42 U.S.C. §§ 7401-7661), Clean Water Act of 1972, as amended (P.L. 92-500, 33 U.S.C. §§ 1251-1387), Coastal Zone Management Act of 1972, as amended (P.L. 92-583, 16 U.S.C. §§ 1451-1466), Federal Insecticide, Fungicide, and Rodenticide Act of 1947, as amended (P.L. 80-104, 7 U.S.C. §§ 136-136y). Individual states may have or create applicable regulations regarding various proposed activities related to the SLF Control Program. USDA-APHIS works cooperatively with State agencies to identify applicable State regulations to ensure compliance, during implementation of any proposed pest control, and while conducting program monitoring. This section summarizes information used in consultations with other agencies and in USDA-APHIS analyses.

Threatened and Endangered Species

Section 7 of the ESA and its implementing regulations require Federal agencies to ensure their actions are not likely to jeopardize the continued existence of listed threatened or endangered species, or result in the destruction or adverse modification of critical habitat. If species or critical habitat is present in the proposed program area, USDA-APHIS conducts Section 7 consultation with the FWS and National Marine Fisheries Service (NMFS), on a site-specific basis for SLF control activities. SLF has the potential to affect listed species and their habitats where ever it establishes. USDA-APHIS would continue to consult with FWS or NMFS, as necessary, when there is confirmation of an SLF infestation. In addition, USDA-APHIS would implement measures prior to the initiation of program activities to protect federally listed species and critical habitat.

Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act (16 U.S.C. 668–668c) prohibits anyone, without a permit issued by the Secretary of the Interior, from "taking" bald eagles, including their parts, nests, or eggs. Each year there are reports of active and fledgling nests within the counties. During their breeding season, bald eagles are sensitive to a variety of human activities. The U.S. FWS recommends buffer zones from active nests, and USDA-APHIS will continue to meet the recommendations (as described in the SLF EA for Berks, Lehigh, and Montgomery County) in every area where program activities may occur. USDA-APHIS does not intend to use clear-cutting; USDA-APHIS will contact the U.S. FWS for locations of eagle nests in program areas as they are identified, and contact U.S. FWS before tree removal begins during the breeding season within 660 feet of a nest to confirm that all eagles have left the nest.

Migratory Bird Treaty Act

The Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. §§ 703–712) and Executive Order 13186, "Responsibilities of Federal Agencies to Protect Migratory Birds," led USDA-APHIS to implement a memorandum of understanding (MOU) with the U.S. FWS which promotes the conservation of migratory bird populations. Tree-of-Heaven can provide shade and roosts for nesting birds (Wynne, 2002). During the nesting season, any Tree-of-Heaven plants targeted for removal will first be examined for active bird nests. If this is the case, they will not be removed until after the young have fledged.

A bird migration route follows the Atlantic Coast and the Appalachian Mountains, and program areas are likely to receive a large number of songbirds and waterfowl that fly north along the Atlantic flyway. Every spring, many migrant birds either nest within the Mid-Atlantic region or continue northward migrations. IBAs exist in the affected environment. The presence of SLF could create an additional food source for birds who overcome SLF prey defenses and consume the insects despite distasteful defensive alkaloids and layered behavioral responses over time.

Acute and chronic toxicity to birds from insecticides (dinotefuran and imidacloprid) and herbicides (triclopyr, imazapyr, and metsulfuron-methyl) are as discussed in Appendices E and F of the Programmatic ALB Eradication EIS (2015), which are incorporated by reference. Aminopyralid and glyphosate risk to birds have been summarized in previously referenced U.S. Forest Service risk assessments.

Depending on the chemical, toxicities range from low to moderate, and program treatments to select *A. altissima* plants would not likely expose birds to these pesticides. Birds are unlikely to consume SLF, so dietary exposure from the consumption of SLF insects exposed to sub-lethal doses of the pesticides is highly unlikely. Therefore, these insecticides would not likely impact migratory birds. In general, the targeted spray of trap trees would not result in impacts on bird prey.

Executive Orders and National Historic Preservation Act

Executive Order (EO) 12898, “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,” requires Federal agencies to conduct their programs, policies, and activities so that Native American, minority, and low-income communities are not subjected to disproportionately high or adverse human health or environmental effects.

State census statistics are unlikely to reveal data that can identify potentially affected Native American, minority, or low-income communities because these results combine data from populations of 5,000 or more individuals (U.S. Census Bureau, 2017). As program activities expand to new areas, program personnel will provide educational outreach on the purpose and methods of control efforts regardless of whether in the rural or urban landscape, particularly if there is to be tree removal as part of the efforts. In rural areas, landowner cooperation will be essential to reach host trees that are not on public lands. Based on the program's proposed treatment methods, the pesticide exposure risk to humans will be very low regardless of rural or urban location. For these reasons, the proposed action appears unlikely to pose any disparately high and adverse impacts to Native American, minority, or low-income communities.

EO 13045, “Protection of Children from Environmental Health Risks and Safety Risks,” acknowledges that children, as compared to adults, may suffer disproportionately from environmental health and safety risks because of developmental stage, greater metabolic activity levels, and behavior patterns. Program activities will not occur on school properties. Children are not likely to see or hear program activities as they occur. Based on the proposed action’s pesticide application methods and storage precautions, it is extremely unlikely that children will be directly exposed to the pesticides. The presence of very few treated trees means movement of insecticide-containing leaves into the environment (particularly as they drop in the autumn) may lead to extremely dilute concentrations in mixed species of leaves on the ground. Unless the trap trees are near normal play areas and there is no leaf removal, children are unlikely to play in leaf piles that could expose them to residual program chemicals.

The National Historic Preservation Act of 1966, as amended (16 U.S. Code § 470 et seq.), requires Federal agencies to consider the impact on properties included in, or eligible for inclusion in the National Register of Historic Places (36 Code of Federal Regulations §§ 63 and 800). USDA-APHIS determined the proposed action is an undertaking with no potential to affect historic properties because the program activities do not affect human-made structures, and the pesticides will not be placed on listed buildings. Disturbances to the soil will be associated with landscape plants (and not the listed structures), extremely shallow (less than 2 feet deep), and ephemeral. They will not alter or impact the vistas of currently recognized historic places. Noises will consist of unamplified worker communications, and ephemeral sounds associated with the use of backpack sprayers and tree removal equipment. There will be no clear-cutting of trees in the landscape.

Many historic sites exist within the Mid-Atlantic region. Treatments for SLF on historic properties are not anticipated at this time. USDA-APHIS is in the process of contacting State Historic Preservation Officers (SHPO) in all of the states by providing information on the program. Virginia and Pennsylvania SHPOs were contacted for prior EAs. If treatment on a historic site becomes necessary in the future based on survey detections, treatments would be applied only with consent of property owners or managers. To the extent that individual properties may wish to participate in surveys, or destroy and report destruction of egg masses, they are encouraged to do so through the PDA's program at: https://www.paplants.pa.gov/EntomologySurveyExternal.aspx?survey=SCRAPE2018 .

APHIS finds the area of potential effects for Section 106 consultation is based on the identification of the quarantine area, which will be the area receiving the direct effects of control activities. Generally, historic sites tend to be publically or privately owned properties consisting of buildings with associated landscaping. Our concern is ensuring that sites with specimen landscaping and historic properties dedicated to vegetation conservation will not be affected. Program activities include application of pesticides to exterior landscape plantings. Following chemical applications, there will be no visual, atmospheric, or audible effects. Any visual, atmospheric, or auditory effects during application of program chemicals will be limited in duration and intensity. Pesticide application procedures are modified to avoid fruit. APHIS' program activities will not alter, change (restore or rehabilitate), modify, relocate, abandon, or destroy any historic buildings, edifices, or nearby infrastructure; therefore, APHIS program activities will not directly or indirectly alter characteristics of a historic property that qualify it for inclusion in the National Register. As far as potential cumulative impacts are concerned, APHIS does not find that any reasonably foreseeable effects caused by the program activities will occur later in time or be farther removed in time.

EO 13175, "Consultation and Coordination with Indian Tribal Governments," calls for agency communication and collaboration with Tribal officials when proposed Federal actions have potential Tribal implications. The Archaeological Resources Protection Act of 1979 (16 U.S.C. §§ 470aamm), secures the protection of archaeological resources and sites on public and Tribal lands. APHIS is using the list of Tribal contacts at www.penndotcrm.org to determine Tribal entities with potential interests. Identification of Tribes with interests in other areas occurs as program activities expand. APHIS will provide Native American contacts with information about the SLF Control Program, and offer their leadership the opportunity to consult with the USDA. The proposed action is highly unlikely to affect Native American sites or artifacts because soil disturbances are likely to be associated with landscape plantings on already disturbed sites. If APHIS discovers any archaeological resources, it will notify the appropriate individuals.

The proposed action is highly unlikely to affect Native American sites or artifacts because soil disturbances are likely to be associated with landscape plantings on already disturbed sites. Nevertheless, if USDA-APHIS discovers any archaeological or Tribal resources, it will notify the appropriate individuals.

Uncertainty and Potential Cumulative Impacts

Uncertainty in this evaluation arises whenever there is a lack of information about the effects of a pesticide's formulation, metabolites, and properties in mixtures that have the potential to impact non-target organisms in the environment. These uncertainties are not unique to this assessment, and are consistent with uncertainties in human health and ecological risk assessments with any environmental stressor. There is uncertainty in where an SLF infestation may occur in the United States, the extent of pesticide use during a given infestation, and the influence of site-specific factors. Uncertainty arises from the potential for cumulative impacts from using multiple pesticides, having repeat exposures, and co-exposure to other chemicals with similar modes of action. Theoretically, cumulative impacts may result in synergism, potentiation, additive, or antagonistic effects. From a human health perspective, the SLF program use of pesticides is expected to pose negligible cumulative impacts based on the targeted modes of application which make it unlikely for the pesticides to enter the food chain or drinking water.

V. List of Agencies and Persons Consulted

Pennsylvania Department of Agriculture
Bureau of Plant Industry
2301 North Cameron Street
Harrisburg PA 17110

U.S. Department of Agriculture
Animal and Plant Health Inspection Service
Plant Protection and Quarantine
Plant Health Programs
4700 River Road, Unit 134
Riverdale, MD 20737

U.S. Department of Agriculture
Animal and Plant Health Inspection Service
Policy and Program Development
Environmental and Risk Analysis Services
4700 River Road, Unit 149
Riverdale, MD 20737

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