Animal and Plant Health Inspection Service
U.S. DEPARTMENT OF AGRICULTURE

Spotted Lanternfly Control Program in the Mid-Atlantic Region, North Carolina, Ohio, and Kentucky

Supplemental Environmental Assessment

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I. Introduction

A. Background

The U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS) is considering additional actions that will assist with control and treatment of spotted lanternfly (SLF), *Lycorma delicatula*, to slow the spread of this invasive insect. SLF is a planthopper (family Fulgoridae, order Hemiptera) that is native to Asia. The insect was first detected in the U.S. in 2014 in Pennsylvania. SLF nymphs are generalists and feed on a wide range of plants (USDA-APHIS, 2014), while SLF adults prefer *Ailanthus altissima,* otherwise known as Tree-of-Heaven and stinking sumac, for feeding, overwintering, as well as egg laying. Adult SLF will also feed on grapevines (*Vitis vinifera*); stone fruits (almond, apricot, cherry, nectarine, peach, and plum); and, other tree species (e.g., apple, oak, pine, poplar, and walnut), if necessary. If allowed to spread, USDA-APHIS is concerned that SLF could prove harmful to grape, apple, peach, stone fruit, and logging industries throughout the country.

Since publication of the "Spotted Lanternfly Control Program in the Mid-Atlantic Region, North Carolina, Ohio, and Kentucky Environmental Assessment" in June 2020, an alternate method of insecticide application and two additional application use sites are being considered for use in five of the twelve states in the SLF Program area. In addition, the treatment area would be expanded to three more counties in West Virginia. Consequently, this Supplemental Environmental Assessment (SEA) incorporates the June 2020 EA and Finding of No Significant Impact (FONSI) by reference and adds new information regarding the potential expansion of application methods and use sites.

Adult SLF are approximately one 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).

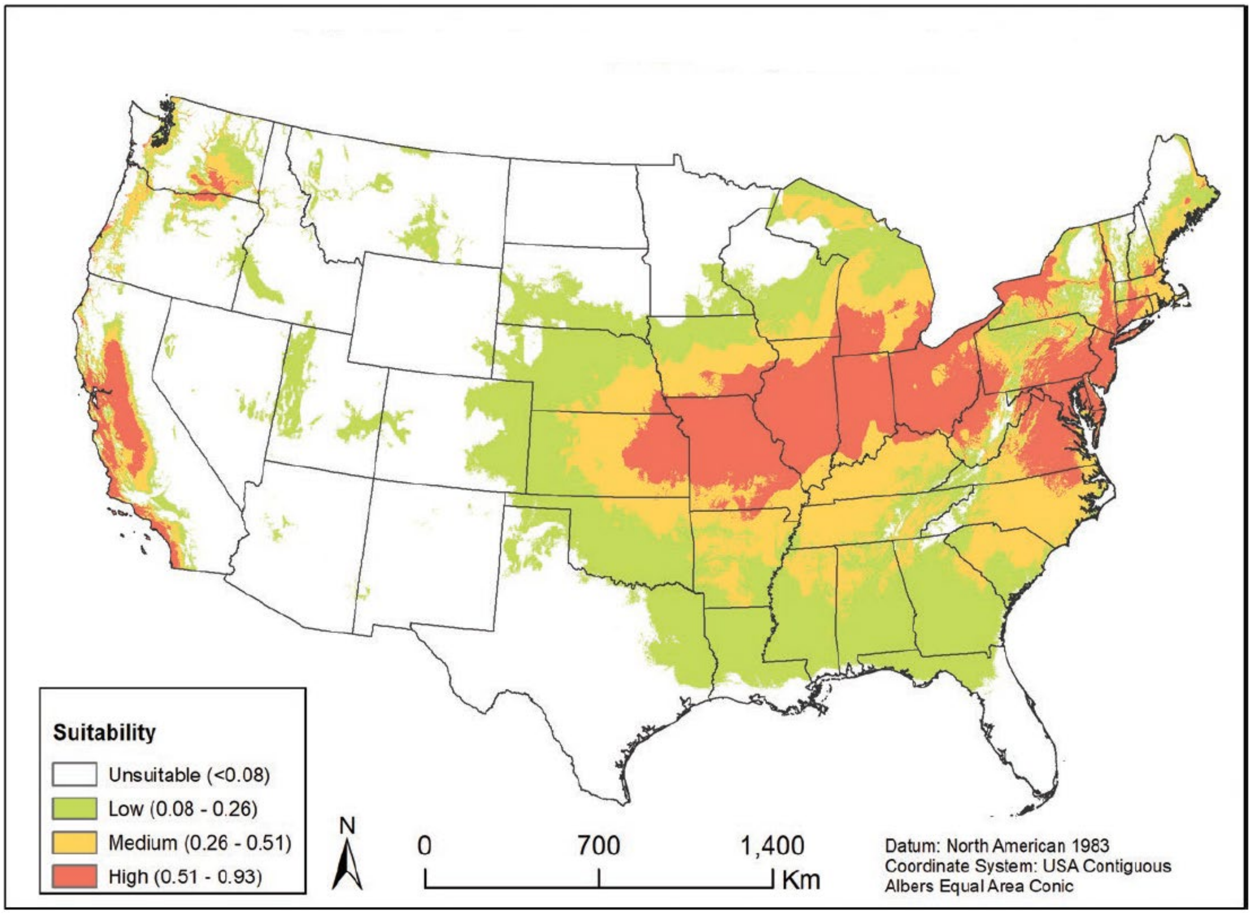
Adult SLF lays their eggs on smooth host plant surfaces and on non-host material, such as bricks, stones, and dead plants. Egg masses are yellowish-brown in color and covered with a gray, waxy coating prior to hatching. Eggs hatch in the spring and early summer. Egg masses can easily be transported long distances on a wide variety of non-food commodities such as rocks, 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).

Both nymphs and adult SLF damage host plants when they feed by sucking sap from stems and leaves. This reduces photosynthesis, weakens the plant, and eventually may contribute to the plant's death. SLF feeding can cause the plant to ooze or weep down the exterior of the tree (Dara et al., 2015) and the insects themselves excrete large amounts of fluid (honeydew), potentially increasing the rate of tree decay. The sap and other fluids promote mold and fungi growth and attract other insects (PDA, 2018). USDA-APHIS does not have 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 additional pests and pathogens.

Pest damage leading to changes in forest composition is well-characterized (McGarvey et al., 2015; Mikkelson et al., 2013). Impacts in the Pennsylvania SLF quarantine zone have been considered significant by the state and SLF spread could be potentially devastating for the state's agriculture and forestry industries (Harper et. al, 2019). A 2019 study in Pennsylvania, estimates that direct impacts of SLF damage in the state will amount to $13.1 million in damage even if SLF was successfully limited to the current quarantine zone, an additional $7.7 million damage if SLF expands to counties adjacent to the quarantine zone, and a total of $42.6 million if SLF expands statewide (Harper et. al., 2019). Estimates were based on USDA's 2017 crop market values and surveys of crop production experts. Researchers indicate limited information on crop specific SLF damage. For example, it is difficult to distinguish the cause of or relative contribution of losses, as in the case of winter injury and SLF feeding on grapes; therefore, estimates are "unrefined" and subject to revisions as new information becomes available. Significant damage from SLF has been reported specifically on grapevines. SLF feeding on grapevines can result in increased susceptibility to winter injury, failure of vines to set fruit in the subsequent year, and death of vines (Leach et al., 2019). However, SLF is a highly mobile pest, with nymphs and adults unlikely to be associated with commodities that are produced and moved for sale, and international and domestic trade impacts are expected to be minimal, with the exception of the impacts from the implementation of local quarantines (USDA-APHIS, 2014).

As of March 2021, SLF has established populations in 9 states. SLF was first discovered in North America in 2014 on a small number of properties in southeastern Pennsylvania. The population has since expanded into various areas of Pennsylvania as well as parts of Connecticut, Delaware, Maryland, New Jersey, New York, Ohio, Virginia, and West Virginia. Control programs in these areas are as described in prior SLF EAs and their related decision documents, a FONSI. This SEA incorporates the five prior SLF control EAs and their FONSIs by reference. See all five prior EAs and their FONSIs at https://www.aphis.usda.gov/aphis/ourfocus/planthealth/plant-pest-and-disease-programs/ea/ct_slf.

Wakie et al. 2020, assessed the risk of SLF becoming established in the U. S. using the ecological niche model MAXENT. Wakie predicted that SLF can become established in most of New England and the Mid-Atlantic States, as well as central United States and the Pacific Coast States. See figure 1 below. Areas shaded in orange, yellow, and green indicate high, medium, and low suitability, respectively. Unshaded/blank areas indicate areas that are unsuitable for SLF establishment.



B. Purpose and Need

USDA-APHIS has the responsibility to take actions that exclude, eradicate, and control plant pests under the Plant Protection Act of 2000 (7 United States Code (U.S.C.) 7701 et seq.). Due to the potential effects of SLF to agriculture and forest host plants, the goal of the SLF Program is to increase USDA-APHIS' and their cooperator's preparedness by having a combination of actions available for deployment when and where SLF populations may occur.

Despite current efforts, the population of SLF continues to spread. The Program has determined that rail lines and intermodal areas are a high-risk pathway for long distance spread of SLF (figure 2). In addition, recently hatched SLF nymphs can climb to a height of more than 5 meters (16.5 feet) within trees (Kim, J.G., et al., 2011) warranting new application methods. Chemical application types previously considered include hand-held backpack and truck-mounted sprays that cannot reach these heights; USDA-APHIS is proposing to use ground-based mist blowers that can treat SLF nymphs and adults. Mist blowers are sprayers use a fan to blow insecticide emitted through nozzles into a directed mist through a volute. They are useful for treatment of large areas and applying insecticide into areas of dense foliage where SLF is present.

This SEA considers the use of mist blowers in applying insecticides for SLF control along railways, train yards and intermodal rail terminals. Intermodal rail terminal can include docks, part of a port facility (on-dock or near-dock facilities) or be a stand-alone inland terminal. The terminals include areas where trailers are transported on rail and then offloaded and driven by trucks (tractors) or vice versa, containers and trailers are dropped off for transport by rail.

This SEA was prepared consistent with the National Environmental Policy Act of 1969 (NEPA), 2020 NEPA updates, and the 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 actions. Notice of the availability of the draft SEA was published in newspapers within each of the five states where changes to the SLF control program is proposed. The draft SEA was made available in regulations.gov (APHIS-2020-0042-0003) on August 19, 2021, for a 35-day public comment period. APHIS received 1 comment regarding the control measures outlined in the draft SEA; the comment is addressed in appendix B of this final SEA.

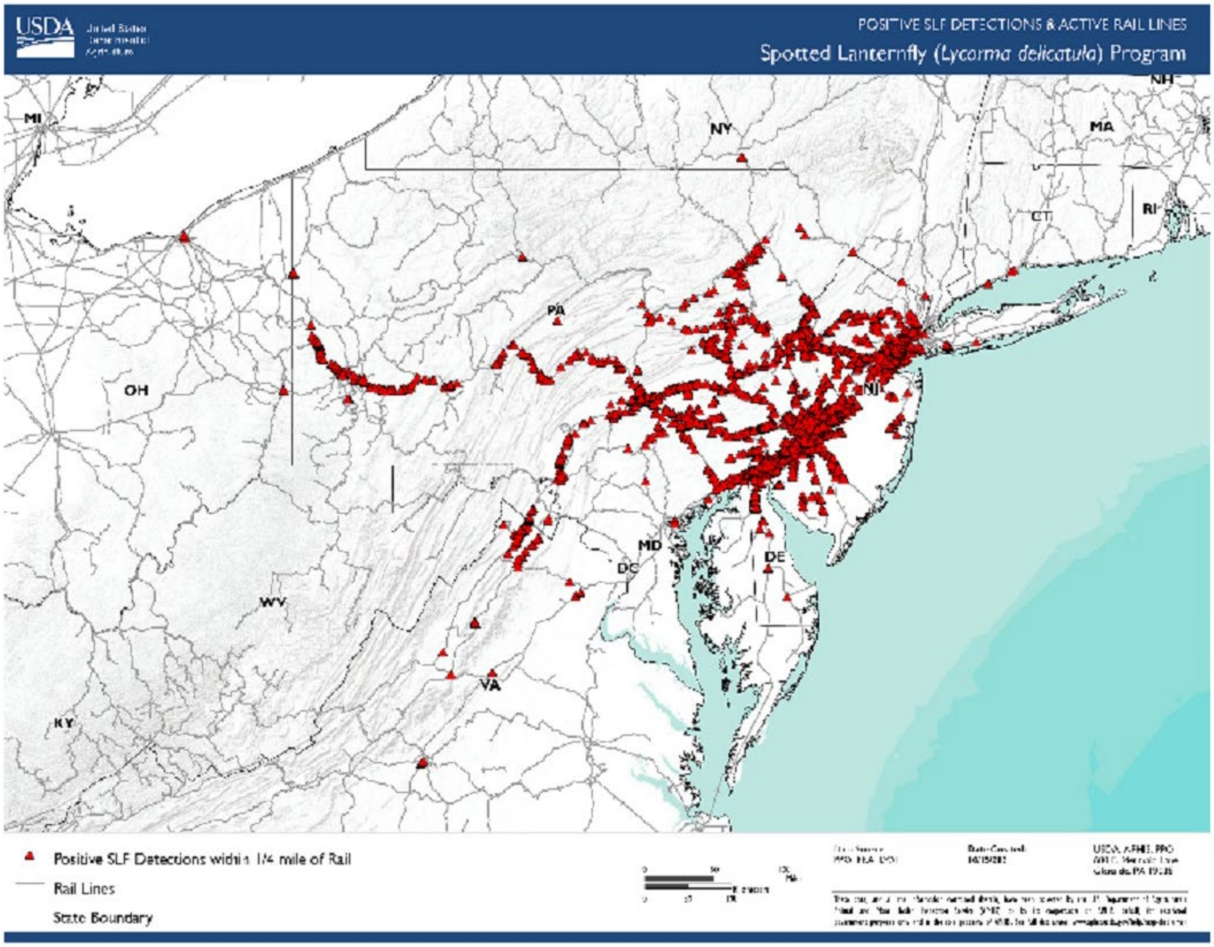


Figure 2. Positive SLF Detections & Active Rail Lines for Treatment Area

II. Alternatives

Three potential action alternatives for the SLF Program are outlined and compared below.

A. No Action Alternative

Under the no action alternative, USDA-APHIS will continue the current program actions, as analyzed in the June, 2020 EA (EA found at the following website: https://www.aphis.usda.gov/plant_health/ea/downloads/2020/slf-mid-atlantic-region.pdf). Control efforts would include any or all the following: herbicide applications, tree bands and traps, insecticide applications, detection and visual reconnaissance surveys, and egg mass scraping and treatment. Locations of the SLF Program include Connecticut, Delaware, District of Columbia, Maryland, New York, New Jersey, Pennsylvania, Virginia, West Virginia, North Carolina, Ohio, and Kentucky.

Potential program applied insecticides include the following:

- dinotefuran on tree trunks of trap trees applied via hand-held or backpack sprayer.
- imidacloprid on tree trunks of trap trees applied via tree injection.
- bifenthrin, beta-cyfluthrin, or *Beauveria. bassiana* on ornamental and *A. altissima* tree trunks in commercial and residential areas, perimeter areas and surfaces in and around train yards, airports, seaports, trucking depots, railway and powerline easements; applied via truck-mounted sprayers for railways and powerline easements, hand-held backpack sprayers for all other use sites.
- soybean oil on SLF eggs attached to various surfaces including trees, ground litter, firewood, nursery stock, rocks, vehicles, or on other articles moved in interstate commerce applied via hand-held or backpack sprayers.
- Dichlorvos strips placed within circle traps attached to tree trunks.

Under the no action alternative, USDA-APHIS will continue to use the above combination of measures in an integrated manner on an as-needed basis when there are SLF detections. Table 1 summarizes the insecticides that may currently be used in the SLF Program, as well as each insecticide’s proposed use sites and application methods.

Table 1. No Action Chemical Treatments, Use Sites, and Application Methods

Chemical	Use site	Application method
dinotefuran	Tree trunks of trap trees	hand-held or backpack sprayers
imidacloprid	Tree trunks of trap trees	tree injection
bifenthrin OR beta-cyfluthrin OR *Beauveria bassiana*	Ornamental and *A. altissima* tree trunks in commercial and residential settings Perimeter areas and surfaces such as hedges, fences, light poles, buildings, or other structural elements in and around ports of entry, train yards, airports, seaports, and trucking depots. Rocks, plants, debris along railways and powerline easements	hand-held or backpack sprayers truck-mounted sprayers for railways and powerline easements
soybean oil	SLF eggs on trees and other surfaces	hand-held and backpack sprayers
dichlorvos	Within circle trap containers placed on *A. altissima* tree trunks	vapor releasing strips

*Control measures are same as those outlined as the preferred alternative in the June 2020 EA.

B. No Treatment Alternative

Under the no treatment alternative, USDA-APHIS will not provide funding for SLF control. Other government agencies and private landowners may work to eradicate SLF; however, there will be no cooperative or coordinated efforts among USDA-APHIS and other stakeholders. If any SLF-control actions are taken, efforts will primarily be completed by State workers, Federal District workers, and volunteers.

C. Preferred Alternative

Under the preferred alternative, USDA-APHIS is proposing a continuation of the current action alternative analyzed in the June 2020 SLF EA, with the addition of the application of bifenthrin and beta-cyfluthrin with ground-based mist blowers on trees and vegetation along railways, in train yards, and around intermodal facilities. Treatments with mist blowers could occur in the following state counties:

- Maryland- Alleghany, Frederick, and Washington county.
- Ohio- Belmont, Carroll, Columbiana, Harrison, and Jefferson county.
- Pennsylvania- statewide.
- Virginia- Albemarle, Augusta, Bath, Clarke, Frederick, Highland, Loudoun, Nelson, Page, Rockbridge, Rockingham, Shenandoah, and Warren county.
- West Virginia- Berkeley, Brooke, Hancock, Jefferson, Morgan, and Ohio county.

USDA-APHIS will continue to use a combination of measures in an integrated manner on an as-needed basis when there are SLF detections. Control efforts will continue to include any or all the following: herbicide applications, tree bands and traps (including circle traps), insecticide applications, detection and visual reconnaissance surveys, and egg mass scraping. All measures outlined below are identical to those in the no action alternative, except for the details of insecticide use.

1. *A. altissima* Control with Herbicides

USDA-APHIS employees, contractors, and its cooperators will use herbicides to control *A. altissima* up to a 1/4-mile radius from SLF infested trees. USDA-APHIS will apply triclopyr or a combination of the herbicides triclopyr, imazapyr, and metsulfuron-methyl on tree wounds or small tree trunks. The SLF Program will also use foliar applications of aminopyralid and glyphosate to treat sprouting *A. altissima*. One or a mixture of several herbicides may be used. All applications will be made either by hand painting undiluted material on the trunk of the *A. altissima* seedling or sapling or directly spraying 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 (WDNR, 2012; 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, 2015a; USDA-FS, 2004). Aminopyralid is a systemic selective carboxylic acid herbicide that affects plant growth regulators, or auxins, and has multiple non-agricultural uses. (USDA-FS, 2007). Glyphosate is a 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.

On rare occasions, the SLF Program may need to manually remove dying *A. altissima* that are treated with herbicides if the tree poses a risk to human safety or to the physical environment, such as powerlines. Because very few trees will be removed, there is a low potential for impacts; therefore, potential impacts from tree removal will not be discussed further.

2. Tree Bands and Circle Traps

Tree bands are a form of sticky wrapping that is placed around the tree trunk and act as a trap, preventing SLF from moving up the tree. There are various types of tree bands. The bands contain either an inward or outward-facing sticky band. SLF crawl up the tree, run into the bands, and are caught in the adhesive. The SLF Program and its cooperators will use sticky tree band traps on *A. altissima* from May (when SLF hatch) to November (when adult SLF populations die) to capture SLF while they move up the trunk or congregate to feed and mate. The bands will be removed and replaced every two weeks.

Additionally, circle traps will be used on *A. altissima*. Circle traps are recommended over sticky traps because they are more effective at capturing SLF and reusable (Francese et. al., 2020). A vapor-releasing dichlorvos insecticide strip will be placed in the insect trapping container to kill captive SLF (dichlorvos will be discussed further under the section on insecticides). Both the inward-facing tree bands and circle traps are designed to reduce by-catch (i.e., other insect and animal species that are caught unintentionally) relative to outward-facing sticky tree band traps.

3. Insecticide Treatments

The insecticides proposed for use under the preferred alternative are the same as those used currently under the no action alternative. The difference is there are additional potential use sites and a newly proposed application method. As in the no action alternative, only licensed applicators or persons working under the supervision of a licensed applicator will apply insecticides. Application of insecticides on private land will occur only with landowner consent. Applicators will follow the product container Federal Insecticide, Fungicide, Rodenticide Act (FIFRA) section 3 label instructions regarding the use of protective equipment, use limitations, dosage, entry restrictions and all other use directions, unless the use is approved under an alternate registration type, such as a FIFRA section 24(c) approval (see the following U.S. Environmental Protection Agency (USEPA) website for additional information on section 24(c) https://www.epa.gov/pesticide-registration/guidance-fifra-24c-registrations).

Potential program applied insecticides include the following:

- dinotefuran on tree trunks of trap trees applied via hand-held or backpack sprayers.
- imidacloprid on tree trunks of trap trees applied via tree injections.
- bifenthrin, beta-cyfluthrin, or *B. bassiana* on ornamental and *A. altissima* tree trunks in commercial and residential areas, perimeter areas and surfaces in and around train yards, airports, seaports, trucking depots, railway and powerline easements; applied via truck-mounted sprayers for railways and powerline easements, hand-held backpack sprayers for all other use sites.
- bifenthrin or beta-cyfluthrin on trees, vegetations, rocks, and debris along railways, in train yards, and intermodal rail terminals; applied via mist blowers.
- soybean oil on SLF eggs attached to various surfaces including trees, ground litter, firewood, nursery stock, rocks, vehicles, or on other articles moved in interstate commerce applied via hand-held or backpack sprayers.
- dichlorvos strips placed within circle traps attached to tree trunks.

Table 2 summarizes the use of potential insecticides. Proposed changes to the use sites and/or application method, when compared to the no action alternative, are in bold font.

Table 2. Preferred Action Chemical Treatments, Use Sites, and Application Methods

Chemical	Use site	Application method
dinotefuran	Tree trunks of trap trees	hand-held or backpack sprayers
imidacloprid	Tree trunks of trap trees	tree injection
B. *bassiana*	Ornamental and A. *altissima* tree trunks in commercial and residential settings Perimeter areas and surfaces such as hedges, fences, light poles, buildings, or other structural elements in and around ports of entry, train yards, railways, powerline easements, airports, seaports, and trucking depots.	hand-held or backpack sprayers truck-mounted sprayers for railways and powerline easements
bifenthrin OR beta-cyfluthrin	Ornamental and A. *altissima* tree trunks in commercial and residential settings Perimeter areas and surfaces such as hedges, fences, light poles, buildings, or other structural elements in and around ports of entry, train yards, powerline easements, airports, seaports, and trucking depots. Trees, vegetation, rocks, debris along railways, train yards, intermodal rail terminals Trees, vegetation, rocks, debris along railways, train yards, intermodal rail terminals	hand-held or backpack sprayers truck-mounted sprayers for railways and powerline easements Mist blowers for railways, train yards, and intermodal rail terminals
soybean oil	SLF eggs on trees and other surfaces	hand-held and backpack sprayers
dichlorvos	Within circle trap containers placed on A. *altissima* tree trunks	vapor releasing strips

Trap tree treatment

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 treated plant to be exposed to a lethal dose, but the presence of the chemicals only within the plant simultaneously minimizes exposure of non-target organisms.

The SLF Program will apply either dinotefuran through a basal trunk spray or imidacloprid through trunk injection. Trap trees will be created by leaving several live *A. altissima* (generally 10 inches in diameter at breast height (dbh)) on a property after *A. altissima* control efforts. The reduction of *A. altissima* 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 (PDA, 2020).

Tree, vegetation, and perimeter sprays

The SLF Program will apply either a bifenthrin, beta-cyfluthrin, or *B. bassiana* products according to the product label for the treatment of ornamentals and *A. altissima* or as a perimeter application on surfaces such as hedges, fences, light poles, buildings, or other structural elements in and around train yards, airports, seaports, and trucking depots. The chemicals will be applied with a low pressure hand-held, backpack, or truck-mounted sprayer. In the June, 2020 SLF EA, USDA APHIS referred to the use of truck-mounted boom sprayers; however, the term truck-mounted sprayer is more accurate. An insecticide tank is mounted to the truck, with plumbing and a pump that feeds into a spray gun. Truck-mounted gun sprayers have more control than boom sprayers, minimizing drift. In addition, bifenthrin and beta-cyfluthrin can be applied by mist blowers to trees, vegetation, rocks, plants, debris along railways, train yards, and intermodal rail terminals. Mist blower applications will occur one to four times per year. Treatment areas can vary from 0.5 to over 50 acres. The program will take vegetative, water, and sediment samples to monitor for spray drift.

Bifenthrin and beta-cyfluthrin are synthetic pyrethroid compounds made to mimic natural pyrethrins that are refined from chemicals found in chrysanthemum flowers. Pyrethroids alter insect nerve function, causing paralysis in target insect pests, eventually resulting in death (USEPA, 2020a). The chemicals control a broad-spectrum of insects and mites in agricultural and residential settings, both indoor and outdoor on trees, shrubs, foliage plants, non-bearing fruit and nut trees, and flowers in greenhouses, indoor and outdoor plant displays.

B. bassiana is a biochemical pesticide or biopesticide, a naturally occurring substance that control pests. *B. bassiana* is a fungus found naturally in soil that can be used as an insecticide to kill or control various insects. The live fungal spores attach to the surface of the insect, germinate, penetrate the exoskeleton, and rapidly grow within the insect, resulting in death of the insect (USEPA, 2011).

SLF Egg Treatment

Soybean oils used as insecticides are derived from soybean seeds. Insecticide oils can block the air holes through which insects breathe, causing them to die from asphyxiation; act as poisons by interacting with the fatty acids of the insect and interfering with normal metabolism; and, disrupt how an insect feeds (Cranshaw and Baxendale, 2013). The SLF Program will apply a soybean oil insecticide directly to egg masses during winter and early spring, wherever those masses may be, as per the product label. Product label use sites include trees, ground litter, outdoor household articles, recreational vehicles, firewood, nursery stock, rocks, transportation vehicles, or on other articles moved in interstate commerce. Treatment with oil will prevent SLF eggs from hatching. Although soybean oil is of low acute toxicity and employs a non-toxic mode of action, all precautionary label statements will be followed by the applicator to protect human health and the environment.

Dichlorvos Strips in Circle Traps

A vapor-releasing dichlorvos insecticide strip will be placed in the insect trapping container to kill captive SLF. Dichlorvos is an organophosphate that is widely used in treating domestic animals and livestock for internal and external parasites, to control insects commercially and in homes, and to protect crops from insects. Dichlorvos is also found in dog and cat flea collars. The chemical is currently used in traps by USDA-APHIS in the agency's Fruit Fly Program.

4. Detection Survey

Detection survey will use visual inspection to determine if SLF are present. SLF crawl up trees and structures each day and can be observed visually. Tree bands and circle traps (discussed above) will also be used to detect infestations.

5. Visual Reconnaissance Survey and Egg Mass Scraping

Visual reconnaissance surveys identify locations that have feeding damage or presence of SLF on plants. USDA-APHIS will work with cooperators to train local citizens to identify egg masses. USDA-APHIS may also work with cooperators with trained canines who can identify egg masses. The visual surveys occur from October through May and volunteers and program personnel scrape egg masses from plants and other objects with a stiff plastic card into bags with an alcohol solution to cause mortality.

D. Alternatives Considered and Dismissed

Biological control by parasitoids

Natural predation of spotted lanternfly (such as by spiders, praying mantis, spined soldier bugs) within the U.S. occurs, but the levels are not high enough for dependable SLF control. Natural predation is believed to be much higher in China than in the U.S.; SLF is only occasionally a problem in China during years which favor an SLF population boom (Cornell University, 2021). Two parasitoids found in China that evolved in tandem with SLF are *Anastatus orientalis*, an egg parasitoid, and *Dryinus sinicus*, which attack the second and third instar nymphs of SLF. Numerous researchers are testing the potential of these two parasitoids as biocontrol agents in the U.S. The University of Rhode Island is contributing to the host specificity testing of these two potential parasitoids (URI, 2021); exploratory survey studies of SLF in China have occurred (Xin, et al, 2021); and life history and rearing studies of *Anastatus orientalis* have occurred (Broadley, H.J., et al., 2021). However, biological control of SLF by parasitoids is still not very well understood and cannot be considered as a viable option at this time.

III. Potential Environmental Consequences

The below sections consider and compare the potential environmental consequences under the no action, no treatment, and preferred alternatives by summarizing information associated with the physical environment (i.e., air, water, and soil), biological resources (i.e., vegetation and wildlife), human health and safety, equity and underserved communities, Tribal consultation, and any potential historic and cultural resources. The potential impacts may be direct, indirect, and of short or long duration. The impacts may be either beneficial or adverse.

A. No Action Alternative

Under the no action alternative, USDA-APHIS will not make any changes to the current SLF Program. USDA-APHIS will continue to take actions against SLF as outlined in chapter 2. The SLF Program will use a combination of measures in an integrated manner on an as-needed basis when there are SLF detections. The environmental consequences for the no action alternative was previously analyzed in the June, 2020 EA (https://www.aphis.usda.gov/plant_health/ea/downloads/2020/slf-mid-atlantic-region.pdf; chapter III, Potential Environmental Consequences, section c, preferred alternative). Note the no action alternative in this SEA is equivalent to the preferred alternative in the June 2020 EA.

To summarize the findings in the June 2020 EA, impacts to the environment and human health were and still are minimal under this alternative. Urban areas are expected to 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. Use of herbicides and insecticides is minimal and use methods are very controlled, therefore, minimal impacts are expected. Potential impacts associated with *A. altissima* control will be small, local, and short-term. The no action alternative was expected to reduce the likelihood of SLF populations establishing in the country, and minimize further impacts of SLF on the environment, the public, and program operating costs. However, despite these efforts, the SLF population continues to spread along rail lines and intermodal areas.

B. No Treatment Alternative

USDA-APHIS will not provide funding for SLF control under the no treatment alternative. USDA-APHIS will not apply herbicides, use insecticide treatments, use tree traps, or conduct surveys under this alternative. Other government agencies and private landowners may work to control SLF; however, there will be no cooperative or coordinated efforts among USDA-APHIS and other stakeholders. State workers, Federal District workers, and volunteers will be the primary providers of control efforts.

SLF will most likely become established in more areas than under the no action and preferred alternative and impacts from SLF will become widespread over the long-term. Stress induced by SLF attacks could predispose hosts to invasion by other pests and infections by pathogens. Impacts will occur wherever SLF hosts grow, such as urban plantings, orchards, vineyards, and forested areas. The environmental impacts associated with the death of SLF hosts will vary with the intensity of SLF infestation at each site.

In natural ecosystems, reduced growth or the loss of SLF-host trees will create canopy gaps leading to increased establishment of invasive plants, particularly other shade-intolerant vegetation (USDA-APHIS, 2018a). 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 ecosystem processes such as nutrient cycling and retention; and increased ecosystem susceptibility to invasion by exotic plants and animals (Orwig, 2002). The vitality of oak, pine, and walnut trees is likely to be reduced, but the level of tree mortality remains unknown. To date, the invasive potential of *A. altissima* does not appear to be reduced by the presence of SLF.

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.
SLF-host orchard crops, vineyards, and urban trees could sustain damage to the point of needing replanting. Although plant removal in orchards and vineyards regularly occurs as producers

replace less productive plants over time, SLF infestation could increase the rate of replacement if existing trees and vines are not chemically treated. Development of resistant stone fruit tree or grape varieties also will take time and may force producers to incur these costs prematurely (Woodcock et al., 2017).

It is expected that fewer chemical treatments will occur by States and private groups then by USDA-APHIS under the no action and preferred alternatives, so there is the potential for fewer impacts from these chemicals to the physical environment (air, water, and soil). However, there is a small chance States and private groups could apply pesticides, some of which that may have environmental impacts that could be greater than potential impacts from the no action and preferred alternative.

C. Preferred Alternative

Potential environmental consequences from the preferred alternative include impacts from the no action alternative, combined with potential impacts from the treatment of trees, vegetation, rocks, plants, debris along railways, train yards, and intermodal rail terminals with bifenthrin and beta-cyfluthrin using mist blowers in Maryland (Alleghany, Frederick, and Washington counties); Ohio (Belmont, Carroll, Columbiana, Harrison, and Jefferson counties); Pennsylvania (statewide); Virginia (Albemarle, Augusta, Bath, Clarke, Frederick, Highland, Loudoun, Nelson, Page, Rockbridge, Rockingham, Shenandoah, and Warren counties); and, West Virginia (Berkeley, Brooke, Jefferson, Hancock, Morgan, and Ohio counties).

This section considers the potential environmental consequences for the preferred alternative by summarizing information associated with the methods of insecticide application; environmental fate, toxicity, and mitigations associated with each of the insecticides; physical environment; biological resources; human health and safety; equity and underserved communities; Tribal consultation; and, historic and cultural resources. Potential impacts from tree bands and circle traps, detection and visual reconnaissance surveys, and egg mass scraping have extremely low risks and will not be discussed further in any detail. Herbicide treatments have some minimal potential impacts and will be mentioned; however, all impacts are identical to the no action alternative and were discussed in detail in the June 2020 EA. The discussions below will focus on the impacts from insecticide use, with primary focus on the new method of application, mist blowers. The use of mist blowers under the preferred alternative has the potential to increase impacts. Mitigations which will be described within this chapter, must be adhered to so that these potential impacts are minimized.

Potential negative environmental consequences from the spread of SLF, namely impacts to vegetation (e.g., weakening of grape vines) and subsequent indirect impacts to humans (economic losses incurred due to decrease grape production), are expected to decrease, when compared to the no action and no treatment alternatives. The preferred alternative is expected to further reduce the likelihood of SLF populations becoming well-established across the country when compared to the no action alternative, minimizing further impacts of SLF on the environment, the public, and program operating costs.

Table 3 estimates the total number of miles of railways and the number of intermodal facilities present that could potentially be treated with bifenthrin or beta-cyfluthrin with mist blowers and figure 3 shows the location of these sites.

Table 3. Railway Miles and Intermodal Facilities in the Mist Blower Program Area

State	Railways (miles)	No. of Intermodal Facilities
Maryland counties	440	33
Ohio counties	490	2
Pennsylvania	5,130	942
Virginia counties	456	14
West Virginia counties	193	4
Total	**6,659**	**980**

Methods of insecticide application

Tree injections of pesticides can mean lower rates of active ingredients, decreased amount of overall chemical product used, and increased length of protection from pests. Drift on and into surrounding vegetation and water bodies is not an issue. The use of hand-held, backpack and truck-mounted sprayers still allows applicators to have good control over the distribution of the chemicals applied. Treatments can be relatively exact, drift and the unintentional spraying of nontargets is minimized.

The use of mist blowers can be more effective than hand-held, backpack, and truck-mounted sprayers for treating SLF. Mist blowers can treat large outdoor areas quickly, disperse the insecticide into areas of dense foliage, and reach higher branches and foliage than other spray options. However, this increased efficacy comes at a potential cost to the environmental health. The ability for the insecticide to be sprayed over a greater area also means an increased chance for spray drift. To ensure minimal impacts from mist blowers, it is extremely important to adhere to label mitigations. Additionally, the following measures will be applied whenever using mist blowers:

- Do not apply when wind direction favors downwind drift towards nearby water bodies.
- Do not apply when wind velocity exceeds 10 mph.
- Do not treat areas to the point of run-off.
- Do not make applications during rain.

When applying by mist blower, there will be a minimum of a 150-foot no-treatment buffer around any aquatic habitat to protect surrounding waterbodies and aquatic species.

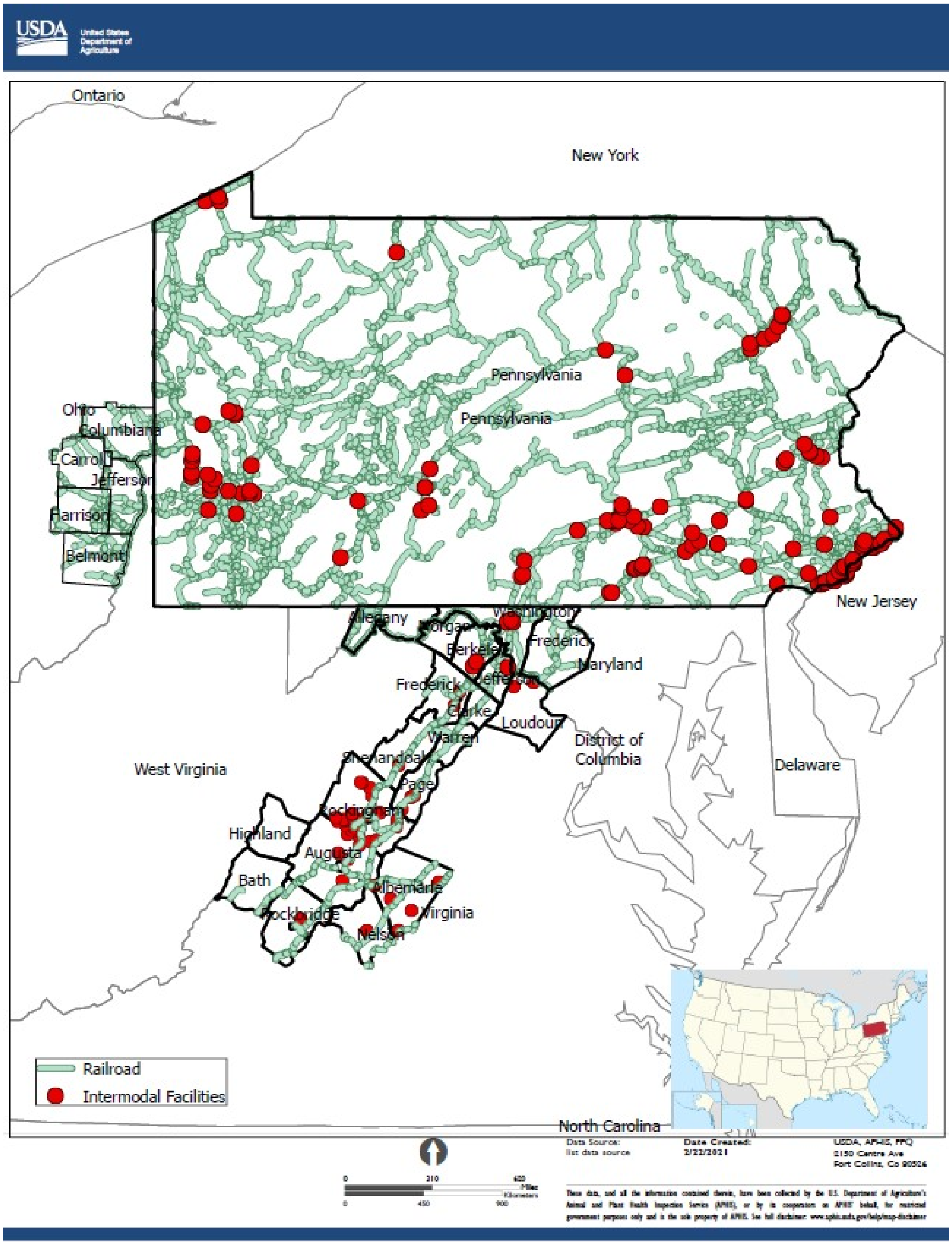


Figure 3. Sites Potentially Treated with Mist Blowers Under Preferred Alternative

<u>Bifenthrin</u>

The ability of a pesticide to move as runoff to non-target habitats is based on environmental fate parameters such as mobility in soil, persistence, and solubility in water. Pyrethroids are relatively persistent in the environment and slow to biodegrade and hydrolyze. Bifenthrin's very low water solubility and hydrophobic (lipophilic) nature leads to strong soil adsorption and a tendency to partition to sediment in aquatic systems (USEPA, 2016a). Bifenthrin is not identified as a cause of impairment for any water bodies listed as impacted under section 303(d) of the Clean Water Act; however, pyrethroids as a group have been identified as cause for impairment for three water bodies, none of which are in the proposed treatment area.

The high octanol/water partition coefficient suggests that bifenthrin will bioconcentrate in aquatic organisms. This is confirmed by the bioaccumulation in fish studies. Bifenthrin is highly bioaccumulative in fish with relatively slow depuration (process of freeing impurities). Risks to all aquatic animals are a dominate concern with pyrethroids (USEPA, 2016a). Pyrethroids are very highly toxic to freshwater and estuarine/marine fish and invertebrates on an acute basis. Bifenthrin is very highly toxic to honeybees (USEPA, 2016b). EPA has identified potential acute risks of concerns to bees and other terrestrial invertebrates from use of pyrethroids (USEPA, 2020). Aquatic vascular plants are not sensitive to pyrethroids (USEPA, 2020). Bifenthrin appears to be slightly toxic to birds on an acute basis (USEPA, 2016b); moderately toxicity to small mammals on an acute basis; and, slightly toxic to terrestrial-phase amphibians and reptiles on an acute basis (USEPA, 2010a).

USEPA classifies bifenthrin as a “possible human carcinogen” (USEPA, 2020). Humans may be exposed to bifenthrin in food and drinking water; bifenthrin may be applied to crops and applications may result in residues of bifenthrin reaching drinking water (USEPA, 2020a). Bifenthrin has low acute toxicity via the dermal and inhalation routes of exposure and has high acute toxicity via the oral route (USEPA, 2020a). Human incident (poisoning) data indicate health effects were primarily neurological, respiratory, dermal, and gastrointestinal; were mild/minor to moderate and resolved rapidly. Most incidents occurred in residential settings, with 33 percent of exposures due to homeowner mixing/loading or applying the product (USEPA, 2020a).

Potential impacts of bifenthrin to human health and the environment from basal tree trunk sprays are expected to be low, provided all label use directions are followed. Bifenthrin label limitations which protect human health and the environment include: not applying when wind speed exceeds 10 miles per hour; no more than one treatment every seven days; no applications to food crops; humans and pets may not re-enter treated area until area it is dry; and, applicators must wear a long-sleeved shirt and long pants, socks, shoes, chemical-resistant gloves, and a respiratory device and protective eyewear when working in non-ventilated spaces. Plants in bloom may be hand sprayed at times when pollinating insects are not present, such as early morning or late evening. The treatments will all be made outdoors. The product manufacturer recommends the use of an alternate class of chemistry in the treatment program to prevent or delay pest resistance.

The application of bifenthrin with a mist blower will increase the potential for impacts to the environment and human health due to the increased height of spray application and the increased risk of spray drift and runoff. Pesticide label application rates and SLF Program mitigations outlined in the section, "Methods of insecticide application" must be followed to minimize impacts. There will be a minimum of a 150-foot no-treatment buffer around an aquatic habitat to protect surrounding waterbodies and aquatic species; spray drift is reduced 96.8% with the application of a 150-foot buffer (USDA-APHIS, 2021). The buffer will also mitigate the likelihood of runoff from applications of bifenthrin.

Beta-cyfluthrin

Beta-cyfluthrin is moderately persistent in the environmental and immobile, binds strongly to soils suggesting a low potential to leach to groundwater, and is moderately bioaccumulative with moderately rapid rates of depuration (USEPA, 2020a). The chemical has high toxicity to fish and aquatic invertebrates and is highly to very highly toxic to honeybees (USEPA, 2016b). EPA has determined that incident reporting will be added to labels to encourage users to report bee kill incidents to EPA (USEPA, 2020b). Pyrethroids do not pose a risk to terrestrial and aquatic plants and acute and chronic risks to birds are not generally expected from pyrethroids (USEPA, 2016b). Risks to mammals are considered low; however, moderate toxicity to algae; and other arthropod species; and, low toxicity to earthworms and other soil macro- or micro-organisms (FAO, 1999). Oral toxicity to humans is high, dermal toxicity is low, and inhalation toxicity is high as an aerosol. There is no evidence of genotoxic potential, delayed neurotoxicity, carcinogenic potential, or reproductive effects (FAO, 1999). Beta-cyfluthrin is classified as "not likely to be carcinogenic to humans" (USEPA, 2020b).

Potential impacts of beta-cyfluthrin to human health and the environment from basal tree trunk sprays are expected to be low, provided all label use directions are followed. Humans and pets may re-enter treatment area only after the insecticide is dry. The product cannot be applied to food crops to protect human health. To protect surrounding water, applications may not be made during rain and the treated area may not be watered to the point that run-off occurs. Plants in bloom may be hand sprayed at times when pollinating insects are not present, such as early morning or late evening. Applicators must avoid contact of the product with eyes, skin, or clothing and avoid breathing spray mist.

The application of beta-cyfluthrin with a mist blower will increase the potential for impacts to the environment and human health due to the increased height of spray application and increased beta-cyfluthrin drift. Pesticide label application rates and SLF Program mitigations outlined in the section, "Methods of insecticide application" must be followed to minimize impacts. There will be a minimum of a 150-foot no-treatment buffer around an aquatic habitat to protect surrounding waterbodies and aquatic species. The buffer will also mitigate the likelihood of runoff from applications of beta-cyfluthrin.

Beauveria bassiana

Very minimal impacts to human health and the environment are expected from the use of *B. bassiana*. *B. bassiana* is a naturally occurring substance found in soil and strains are of low toxicity and pathogenicity (USEPA, 2020b). Residues are not expected to remain on treated food or feed and available information indicates that use of the fungus as a pesticide is not expected to have adverse effects on human health or the environment (USEPA, 2020b). Special precautions should still be taken for applicators, such as personal protective equipment (PPE), all of which are outlined on product labels. *B. bassiana* products can be reapplied as necessary. Intense pest outbreaks may require a combination of the product with a compatible insecticide.

Dinotefuran

Dinotefuran is readily soluble in water and volatilization and bioaccumulation in aquatic organisms is negligible. Dinotefuran is persistent in aquatic environments except for conditions that favor aqueous photolysis (USEPA, 2020c). According to USEPA, dinotefuran is practically non-toxic to moderately toxic to birds, terrestrial-phase amphibians, and reptiles and practically non-toxic to mammals on an acute basis. The chemical is highly toxic to adult bees on an acute contact and oral basis (USEPA, 2020c). No risks were identified for terrestrial plants. Risks of concerns were identified to freshwater invertebrates on acute and chronic basis. No effects observed for freshwater, estuarine/marine fish, and aquatic plants (USEPA, 2020c).

Minimal impacts to human health and the environment are expected from tree injections and/or hand-held and backpack spraying of dinotefuran on trap trees. Dinotefuran is classified as “not likely to be carcinogenic to humans” (USEPA, 2020c). Dinotefuran has low acute toxicity by oral, dermal, or inhalation exposure routes to humans (USEPA, 2020c). While human incidents from the use of dinotefuran are reported to USEPA, they are of low severity and are not a concern to the agency at this time (USEPA, 2020c).

Dinotefuran treatments will not occur when the tree bark is wet, during rainfall, or if rain is expected within 12 hours after application. Applicators will wet, but not saturate, the tree bark so that ample product is applied while avoiding excess product that could runoff into adjacent soil. The SLF Program will not apply dinotefuran when trees are dormant, flowering, under drought stress, or while not actively taking up water from the soil.

Imidacloprid

Imidacloprid is readily soluble in water and volatilization and bioaccumulation in aquatic organisms is negligible; it is considered persistent in aquatic environments except for conditions that favor aqueous photolysis. Imidacloprid is moderately toxic to mammals on an acute exposure basis; highly toxic to birds on an acute oral exposure basis and slightly toxic on a subacute dietary exposure basis; very highly toxic to adult honeybees. The chemical was not found to be toxic to terrestrial plants (USEPA, 2020d). Imidacloprid presents risk of concern to freshwater and saltwater invertebrates on a chronic basis. Acute risks were not identified for saltwater invertebrates, no direct risks of concern were noted to fish or aquatic phase amphibians, and extremely low risks to aquatic plants (USEPA, 2020d).

Imidacloprid is considered non-carcinogenic for humans. The chemical exhibits high oral lethality and low dermal and inhalation lethality; however, most occupational handler risk estimates were not of concern with appropriate baseline PPE (log-sleeved shirt, long pants, shoes, socks, and possibly gloves) (USEPA, 2020d). Human health incidents recorded from January 2016 until August 2019 included 252 reports, 19 were classified as major severity, 233 classified as moderate severity. The 19 severe cases included dermal and neurological symptoms (i.e., headaches, numbness, tingling, and one person reported seizures) (USEPA, 2020d).

Imidacloprid will not be heavily used within the SLF Program area. In addition, injection treatments will mean that there will be no drift, eliminating direct contact of the chemical on to surrounding vegetation, soil, and animals, including pollinators. All mitigations on imidacloprid product labels, such as a limit on the number of treatments per year, will be followed to protect the environment and human health.

Soybean oil

Very minimal impacts to human health and the environment are expected from the use of soybean oil. Vegetable oils (except for oil of mustard) are of low acute toxicity and are Generally Recognized as Safe by the Food and Drug Administration, which means the ingredient is considered safe for consumption, and exempted from FDA’s usual food additive tolerance requirements. Vegetable oils employ a non-toxic mode of action. The oils are formulated in low concentrations into products that are used at low volumes in the United States, so exposure to humans and the environment is expected to be low (USEPA, 1993). USEPA has received no incident reports of adverse effects for vegetable oil pesticides.

The SLF Program intends to use a 50% soybean oil solution to treat SLF egg masses via spot treatment. Egg masses on trees, ground litter, rocks, and articles moved interstate, may all be treated. Product labels for vegetable oils have precautionary language that will be followed by the Program to protect human health and the environment. The label requires PPE when handling the product, the oil cannot be applied to water or in areas where surface water is present, and all disposal directions will be followed. Per product label, no one can re-enter treated areas for four hours unless wearing appropriate protective gear. Since soybean oil is safe to consume, impacts are expected to be minimal when used in a responsible manner as approved by the product label.

Dichlorvos

Dichlorvos volatizes readily in air, has a half-life of 1.5 to 57 days in water, is not known to bioaccumulate in animals or plants, and does not bind to the soil (USEPA, 2007). Dichlorvos has been shown to inhibit acetylcholinesterase and cholinesterase activities in the human nervous system, and effects on nerve functions following dichlorvos exposure during development have been reported (USEPA, 2007). However, there is very little risk of human exposure. Handlers of the dichlorvos insecticide strip should avoid contact with eyes and mouth and avoid breathing vapors. The strips will be difficult for a small child to access because not only are the dichlorvos strips contained within a chamber that would need to be opened, the circle traps are placed at a height on the tree trunk that will be difficult for small children to reach. Additionally, a warning message will be placed on the trap.

In 2018, USDA-APHIS evaluated potential impacts from the use of dichlorvos strips in the fruit fly program. USDA-APHIS found that, provided strips were used according to their label, the probability of exposure to people and the environment were low and risks to human health and the environment were negligible (USDA-APHIS, 2018b). The SLF Program will be using dichlorvos in a similar manner as the Fruit Fly Program and expects to have similar potential impacts.

1. Physical Environment

a) Air

USEPA uses Air Quality Index (AQI) values to indicate overall air quality. AQI considers all the air pollutants measured within a geographic area. For example, in 2018, cities within the proposed treatment states of Connecticut, Delaware, District of Columbia, Maryland, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Virginia, West Virginia all reported no days with very unhealthy air quality. Kentucky, Virginia, and the District of Columbia reported one day; Delaware, Maryland, and West Virginia with three days; Connecticut with six days; and Pennsylvania with seven days of unhealthy air quality (USEPA, 2019). Air quality data for each state in the Mid-Atlantic for every year can be found at https://www.epa.gov/outdoor-air-quality-data/air-quality-index-report.

USDA-APHIS would consider impacts to air resources as significant if they exceeded the NAAQS for particulate matter, ozone precursors. There is the potential for impacts to air from herbicide and insecticide application; however, impacts are expected to be short term, localized, and minor. USDA-APHIS will implement mitigation measures to reduce or avoid any minor or temporary negative impacts to air quality by ensuring the proper use of herbicides and insecticides.

Control of *A. altissima* trees could induce impacts to air quality, but impacts will be short term, localized, and minor. Tree death can decrease local carbon sequestration; however, over time, natural succession will offset carbon dioxide release into the atmosphere. Changes in canopy cover and evapotranspiration due to *A. altissima* control measures may alter stream flow (Mikkelson et al., 2013). These impacts are expected to be offset over time with natural succession.

Mist blowers have the greatest potential for impacting surrounding air quality. To ensure that impacts from spraying mist blowers are minimal, it is extremely important to adhere to label mitigations, such as labeled use restrictions for wind direction, wind velocity, rates of application, and spray droplet size. The SLF Program's applications of bifenthrin and beta-cyfluthrin, *B. bassiana*, and soybean oil with basal tree trunk sprays, as well as use of dichlorvos in circle traps, will all have minimal impacts to air quality, provided labels are followed. Booms sprays will be used as per the label, low to the ground, with appropriate nozzle size and facing the appropriate direction to minimize spray drift. While dichlorvos has harmful vapors, the strips will be used in well-ventilated areas and handlers will ensure they avoid breathing in vapors.

b) <u>*Water*</u>

The Clean Water Act (CWA), the Safe Drinking Water Act, and the Water Quality Act are the primary Federal laws protecting the Nation's waters. Federal activities also must seek to avoid or mitigate actions that will adversely affect areas immediately adjacent to wild and scenic rivers (National Wild and Scenic Rivers Act of 1968, as amended (16 U.S.C. §§ 1271-1287)). Section 402 of the CWA addresses the National Pollutant Discharge Elimination System (NPDES) including those permits related to the discharge of pesticides to waters of the U.S. The USEPA and the states issue Pesticide General Permits under the NPDES program for specific types of pesticide applications. These uses typically include applications for mosquito control, various weed and algae pest control, animal pest control activities in or near water, and forestry canopy pest control where a portion of the pesticide will be applied over and deposited to water. Other pesticide application sites may be subject to individual permits based on recommendations from either USEPA or respective state agency. The five states where mist blower treatments are proposed have responsibility for administration of their respective NPDES permitting programs. APHIS is currently working with each state agency responsible for their NPDES program to determine whether individual NPDES permits are required for the proposed SLF pesticide applications.

Surface water runoff can affect streams and other water bodies' quality by depositing sediment, minerals, or contaminants. Meteorological factors such as rainfall intensity and duration, and physical factors such as vegetation, soil type, and topography influence surface water runoff (USGS, 2020a). Groundwater (e.g., aquifer) levels vary seasonally and annually depending on hydrologic conditions. Groundwater is ecologically important because it supplies water to wetlands, and through groundwater-surface water interaction, groundwater contributes flow to surface water bodies (USGS, 2020b).

Polluted runoff, known as nonpoint source pollution, occurs when rainfall picks up contaminants such as insecticides, sediment, nutrients, or bacteria on its way to lakes, rivers, wetlands, coastal waters, and ground water. Nonpoint source pollution occurs from activities such as fertilizing a lawn, road construction, pet waste, and improperly managed livestock, crop, and forest lands. Today, States report that nonpoint source pollution is the leading cause of water quality problems (USEPA, 2018).

The eastern temperate forest ecoregion is characterized by an abundance of perennial streams and rivers, small areas with high densities of lakes, and a diversity of wetland communities rich in maritime ecosystems (CEC, 1997). USEPA analyzed long-term trends in non-tidal streams and rivers in the Mid-Atlantic. Water quality parameter values across the Mid-Atlantic region such as aluminum and calcium were reviewed, as well as hardness, alkalinity, temperature, and total suspended soils. Broad-scale, long-term trends indicate some recent improvements in water quality in the area. Specifically, phosphorus and organic carbon concentrations have decreased significantly, which allows streams and rivers to recover from eutrophication. Recent short-term trends in some water quality parameters, however, are leveling off or reversing. USEPA suggests earlier improvements are being overwhelmed by continued population growth in the region. Higher levels of total dissolved solids, chloride, and specific conductance reflect impacts of landscape disturbance, road salt application, and possible hydraulic fracturing for natural gas. (USEPA, 2017b).

USDA-APHIS would consider impacts to water resources as significant if they exceeded Federal or State water quality standards. Insecticides and herbicides, when used improperly, can end up in surrounding water bodies. The chemicals can reach waterways from direct spray, drift, or spills or via run-off in solution or on soil particles that are moved by hydraulic forces. All program uses of insecticides and herbicides should be away from surface water and follow additional label directions that eliminate or greatly reduce runoff.

Control of *A. altissima* trees could induce impacts to water quality, but impacts will be short term, localized, and minor. Changes in canopy cover and evapotranspiration due to *A. altissima* control measures may alter stream flow (Mikkelson et al., 2013), while tree mortality adjacent to aquatic resources could reduce shading and alter water temperatures. Degradation of water quality can in turn negatively affect aquatic organism (Englert et al., 2017; Morrissey et al., 2015). These impacts are expected to be offset over time with natural succession.

Mist blowers have the greatest potential for impacting surrounding water quality. There are more than 2,600 wetland and waterbodies within one-half mile of the proposed treatment areas that would use mist blower applications. To protect surrounding water bodies from spray drift and runoff, it is extremely important to adhere to label mitigations and follow SLF protocol. Per the label, bifenthrin may not be applied over an impervious surface, drainage or other conditions that could result in runoff into storm drains, drainage ditches, gutters or surface water. Insecticides should not be applied when wind direction favors downwind drift towards nearby water bodies; not apply when wind velocity exceeds 10 mph; not treat areas to the point of run-off; and, not make applications during rain. When applying by mist blower, there will be a minimum of a 150-foot no-treatment buffer around all aquatic waterbodies.

USDA-APHIS will conduct environmental monitoring with the use of spray drift card samples and water and/or sediment samples, to assess whether SLF Program measures are effective in reducing off-site bifenthrin and beta-cyfluthrin deposition. USDA-APHIS will propose additional mitigation measures if bifenthrin and beta-cyfluthrin residues occur adjacent to, or in waterbodies, that could result in potential effects to aquatic nontarget organisms.

The SLF Program's applications of bifenthrin and beta-cyfluthrin, *B. bassiana*, and soybean oil with basal tree trunk sprays, will all have minimal impacts to water quality, provided labels are followed. Truck-mounted sprays will be used as per the label, low to the ground, with appropriate nozzle size to minimize spray drift. The methods of application that include spot treatments using backpack sprayers must not oversaturating bark, reducing the likelihood of off-site transport of insecticides from drift.

c) Soil

Soil health or soil quality is the ability of soil to function as a vital ecosystem, sustaining plants, animals, and humans (USDA-NRCS, 2020). Soil is an ecosystem that provides nutrients for plant growth, absorbs and holds rainwater, filters and buffers potential pollutants, serves as a foundation for agricultural activities, and provides habitat for soil microbes to flourish (USDA-NRCS, 2020).

The Mid-Atlantic States, as well as North Carolina, Ohio, and Kentucky, have diverse soils with six of the 12 dominant soil orders present: alfisols, entisols, histosols, inceptisols, mollisols, Spodosols, utisols, and vertisol (USDA-NRCS, 2016). Alfisols are fertile soils with high base saturation and a clay-enriched subsoil horizon; entisols are young soils with little or no profile development; histosols are soils that formed in decaying organic material; inceptisols are young soils with a weak degree of profile development; mollisols are very dark-colored, very fertile soils of grasslands; spodosols are acid soils with low fertility and accumulations of organic matter and iron and aluminum oxides in the subsoil; ultisols are soils with low base status and clay-enriched subsoil; and, vertisols are very clayey soils that shrink and crack when dry and expand when wet (USDA-NRCS, 2015).

USDA-APHIS considers impacts to soil resources as significant if proposed activities resulted in substantially increased erosion and sedimentation or adversely affected unique soil conditions. USDA-APHIS does not expect the preferred alternative to have this type of impact. None of the actions proposed under the preferred alternative would increase the potential for erosion or sedimentation.

Many of the activities associated with the SLF Program will result in temporary soil surface disturbance or compaction. The most frequent types of ground disturbance will be from vehicles and pedestrians. These impacts, however, are localized to areas where the program occurs, and the long-term benefits of controlling SLF should outweigh any short-term impacts to soil. *A. Altissima* control could account for some impacts to soil including erosion, alterations to soil microflora, and soil compaction (Foote et al., 2015; Li et al., 2004). Best management practices, such as minimizing activities that expose bare soil to assist in rapid revegetation, can reduce impacts (Aust and Blinn, 2004; Warrington et al., 2017).

Potential negative effects of herbicide and insecticide application could include decreased or altered microbial populations in the soil (Adomako and Akyeampong, 2016); this potential negative effect is expected to be short-term and reversible. Tree trunk injections, spot treatment applications using backpack sprayers, and hand painting the chemical on stumps; all reduce off-site transport of insecticides and herbicides into the soil. Booms sprays and spot treatments using backpack sprayers must not oversaturate bark, reducing the likelihood of off-site transport of insecticides from runoff. Mist blowers have the greatest potential for impacting soil quality. Mist blower applications will occur in industrial sites where soil quality is already impacted but may also occur at railroad right of ways adjacent to natural and managed habitats. To protect soil quality from spray drift and runoff, it is important to not treat areas to the point of run-off and not make applications during rain. Insecticide resides that may occur in soil due to mist blower treatments are expected to have minimal impacts to soil invertebrates and microorganisms. Residues that may occur in soil are subject to degradation reducing exposure over time. Bifenthrin degradation in soil is expected to be slower than beta-cyfluthrin based on longer soil photolysis and microbial degradation half-lives (USEPA, 2016b). Bifenthrin residues may accumulate in soil due to slower degradation half-lives when multiple applications occur at a site. Available studies evaluating the acute and chronic effects of bifenthrin and beta-cyfluthrin show moderate to low toxicity to soil dwelling-organisms (Tu, 1995; Medo et al., 2015; Mali, 2019).

2. Biological Resources

Biological resources include plant and animal species and the habitats where they live. For this SEA, biological resources will focus on vegetation, nontarget wildlife, and protected species. The plant and wildlife subsections include both native and non-native species. Protected species refers to migratory birds protected under the Migratory Bird Treaty Act of 1918 (MBTA), as amended, threatened and endangered species and their critical habitats as protected under the Endangered Species Act (ESA), and bald and golden eagles under the Bald and Golden Eagle Protection Act.

The expanded treatment area will include railway rights-of-way. The treatment area along railways is highly managed and disturbed habitats that receive routine railway traffic and other mechanical and chemical treatments to manage unwanted vegetation. While flora and fauna within rights-of-way are exposed to mowing, herbicides, pollution, as well as the facilitated spread of invasive competitors, the green space may also accommodate a high level of species richness, including biota of conservation concern (Gardiner, M.M., et al., 2018). In addition, USDA-APHIS estimates that there are 185 public land use areas (includes city, county, state and Federal parks, refuges and wildlife management areas) within one-half mile of where mist blowers could be used under the preferred alternative. Biological resources in these areas, as well as surrounding urban areas, need to be considered and protected.

d) <u>Vegetation</u>

A. altissima, the primary host of SLF, is a rapidly growing deciduous tree, native to Taiwan and northeast and central China. The tree was first introduced into Philadelphia in 1784 and then again on the west coast in the 1850s as a valued urban street tree. *A. altissima* has since been widely planted in the Baltimore and Washington D.C. areas. The tree spread from these areas and has become a common invasive plant in urban, agricultural, and forested areas (PennState Extension, 2018). *A. altissima* in forested areas typically occurs in small patches as canopy trees but can also occupy the understory.

Traits that allow *A. altissima* to be so invasive are: ability to grow almost anywhere; rapid growth in dense colonies; prolific seed production; ability to continuously send up root suckers (i.e., shoots that grow from the roots of a plant) as far as 50 feet from the parent tree, even when injured; sprouts as young as two years produce seeds; and, the tree produces chemicals in its leaves, roots, and bark that can limit or prevent the growth of other plants in the area (PennState Extension, 2018). There are minor human health concerns of the tree. As a high pollen producer and moderate source of allergies in some people, skin irritation or dermatitis have been reported; symptoms vary depending on sensitivity of the individual, the extent of contact, and condition of the plant (PennState Extension, 2018).

SLF have many other host trees in addition to *A. altissima.* SLF host trees provide food, shelter, and egg laying sites to SLF. SLF changes hosts as they age and go through various developmental stages (PDA, 2018). Nymphs feed on a wide range of plant species, while adults prefer to feed and lay eggs on *A. altissima*. Table 4 provides a list of some SLF hosts (Dara et al., 2015). The table also indicates whether the plant is native or introduced into the United States.

Table 4. Example SLF Hosts

Host Plant	Common Name (Origin)	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.) Swingle3	Tree-of-Heaven (I)	Simaroubaceae	Adult, nymph; feeding, egg laying
Aralia elata (Miq.) Seem.	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
Juglans nigra L.	Black walnut (I)	Juglandaceae	Nymph
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.	Multiflora Rose (I)	Rosaceae	Nymph; feeding
Salix spp. L.	Willow (I, N)	Saliaceae	Adult; feeding
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 amurensis Rupr	Amur grape (I)	Vitaceae	Adult/nymph
Vitis vinifera L.	Wine Grape (I)	Vitaceae	Adult, nymph; feeding, egg laying
Vitis spp.	Wild grape (N)	Vitaceae	
Zelkova serrata (Thunb.) Makino	Japanese Zelkova (I)	Ulmaceae	Egg laying

I= introduced; N= native

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. SLF hosts 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, 2020). 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, 2020).

Treatment options will increase the level of human activities around the treatment area, which can, to varying degrees, impact ground vegetation. By utilizing best management practices that limit exposing bare soil, USDA-APHIS can minimize these impacts.

Tree bands and traps, and surveys, will have minimal impacts to vegetation. There will be some risk to non-target terrestrial plants from herbicide treatments. However, the potential for effects will be restricted to areas immediately adjacent to the application. Herbicides will be applied directly to the tree surface and applicator inflicted wounds, according to label instructions to minimize 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 tree. These methods minimize impacts to surrounding vegetation.

Reduction of *A. altissima* may cause some limited alterations to vegetative understory; however, impacts are expected to be local and short-term. By utilizing best management practices during *A. altissima* controls, such as minimizing activities that expose bare soil to assist in rapid revegetation, USDA-APHIS can minimize these impacts. The use of bifenthrin, beta-cyfluthrin, *Beauveria bassiana*, and soybean oil using basal tree trunk sprays will have minimal impacts to surrounding vegetation. While mist blowers have the potential to reach the greatest area of vegetation, impacts of bifenthrin and beta-cyfluthrin on vegetation will be extremely low.

e) *Wildlife*

The SLF Program's control of *A. altissima* will result in temporary loss of wildlife habitat that natural succession will restore over time. *A. altissima* in forested areas typically occur in small patches as canopy trees but can also occupy the understory. Changes in canopy cover due to tree control, can degrade surrounding water quality, in turn affecting aquatic organisms through direct or indirect impacts to fish, aquatic insects, and crustaceans (Englert et al., 2017; Morrissey et al., 2015). Any potential for impacts to terrestrial and aquatic systems will be localized and transient since *A. altissima* is not considered to be a dominant tree species over large forested area.

Actions associated with the preferred alternative will temporarily increase the presence or level of human activities (noise and visual disturbance) in the program area. Temporary adverse effects can include increased levels of stress hormones, disturbance or flushing of young broods, and decreased fitness. USDA-APHIS expects the adverse effects associated with this concern to be localized and temporary, and the use of mitigation measures will further reduce the risks of adverse effects.

Wild mammals and birds are at very low risk from herbicide applications due to the low toxicity of 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 form the proposed herbicide applications (USDA-APHIS, 2018a).

B. bassiana and soybean oil are of such low toxicity they pose few additional risks to nontarget wildlife. The limited use of dinotefuran and imidacloprid to tree trunks of trap trees keeps effects localized and exposure risks to a minimum. Additionally, dinotefuran has low to moderate acute and chronic toxicity to nontarget wildlife, such as mammals and birds (for more information, see USDA-APHIS, 2018a). Since imidacloprid is only applied via tree injection, insects must feed on the treated plants to be exposed to a lethal dose; therefore, exposure of non-target organisms is minimized. There are some risks to sensitive terrestrial invertebrates that consume vegetation from ivermectin-treated trees. However, terrestrial invertebrate populations consume a wide range of plants, which should limit the percentage of exposure through their diet.

Use of mist blower treatments increases risks to wildlife that consume pyrethroid treated vegetation and invertebrates. Indirect impacts to wildlife populations through the loss of invertebrate prey is 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. Although it has not been observed within the SLF Program, 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. (USDA-APHIS, 2018a)

Bifenthrin is highly toxic to freshwater fish, aquatic-phase amphibians, and terrestrial invertebrates, including beneficial insects such as honeybees and pollinators. The chemical is very highly toxic to freshwater aquatic invertebrates; has very high acute toxicity to estuarine/marine fish and invertebrates; moderate acute toxicity to small mammals; and, slight acute toxicity to birds, terrestrial-phase amphibians, and reptiles (USEPA, 2010a; USEPA, 2016a; USEPA, 2016b; USEPA, 2020a). Beta-cyfluthrin is highly toxic to fish, aquatic invertebrates, and most terrestrial invertebrates; moderately to algae; highly toxic to honeybees and other arthropod species (USEPA, 2016b; USEPA, 2020a; USEPA, 2020b). The 150-foot no-treatment buffer adjacent to waterbodies will reduce the risk to aquatic species (USDA-APHIS, 2021; see appendix A). Waterbodies include, but are not limited to lakes, reservoirs, rivers, permanent streams, wetlands, natural and manmade ponds, and estuaries. Pesticide label instructions limiting the number of treatments applied and utilizing applications methods that limit or reduce drenching and chemical runoff into soil and nearby water, could minimize impacts to aquatic species. Pesticide application rates and the following SLF Program mitigations would further reduce risks: do not apply when wind direction favors downwind drift towards nearby water bodies; do not apply when wind velocity exceeds 10 mph; do not treat areas to the point of run-off; and, do not make applications during rain.

Pollinators

The use pattern of basal trunk injections and hand-held or backpack sprayers and truck mounted boom sprays will reduce potential impacts to pollinators, and other sensitive terrestrial invertebrates, because they minimize spray drift or they are directed to individual trees such as with basal trunk injections. The application of bifenthrin and beta-cyfluthrin with mist blowers will increase the potential for impacts to pollinators due to the increased height of spray application and the increased risk of spray drift and runoff. Bifenthrin and beta-cyfluthrin are considered very highly toxic to honeybees based on either acute oral or acute contact studies (USEPA, 2016). Beta-cyfluthrin product labels state that applications made directly to crops or weeds are highly toxic to pollinators, such as bees. The label also states not to make applications or allow drift to crops or weeds where bees are actively foraging. Various plant species occur in the use sites proposed for SLF treatments with different blooming periods throughout the treatment season for SLF. These sites will be evaluated prior to application to determine if bees and other pollinators are actively foraging. Per label requirements, applications will be avoided at sites where pollinators are foraging, or when conditions are favorable for drift to areas where pollinators are foraging.

Bifenthrin kills bees on contact during application and will continue to kill bees for one or more days after treatment (Krupke, C.H., et al., 2021). USEPA (2013) reported residual contact lethal effects to honeybees 10 days after application using a formulation of beta-cyfluthrin. USEPA (2017) evaluated the acute risks to pollinators using a screening level analysis and determined application rates for various insecticides that would be considered safe for pollinators. The application rates for bifenthrin and beta-cyfluthrin in the risk assessment that were considered safe to honeybees were approximately two orders of magnitude below the rates proposed in the SLF program using mist blower treatments suggesting the potential for direct acute risk from SLF program treatments. Bifenthrin and beta-cyfluthrin are broad spectrum insecticides and are also considered toxic to other invertebrate pollinators such as butterflies and moths. Krueger et al. (2021) demonstrated lethal and sublethal effects of bifenthrin and beta-cyfluthrin to Monarch butterflies in acute exposures. Similar to previous work, bifenthrin appears to be less toxic to butterflies when compared to beta-cyfluthrin.

The risks to pollinators from mist blower treatments will be reduced based on the proposed areas of application and the implementation of risk mitigation measures designed to reduce exposure. Applications will range from 0.5 to 50 acres in size at intermodal areas and railway rights of way. Some of these treatment areas will occur in industrial areas where pollinating plants are not prevalent, reducing insecticide exposure and risk to pollinators. Risks to pollinators in railway rights of way that are not in industrial areas would be greater due to the presence of pollinating plants and the importance of these use sites to pollinators. Rights of way associated with roads, power lines and rail lines have been identified as having important ecological function to support pollinators in fragmented habitats and to serve as corridors for pollinators between larger foraging resource habitats (Davis et al., 2008; Moron et al., 2014; Wrzesien et al., 2016; Moron et al., 2017; Gardiner et al., 2018; Villemey et al., 2018; Twerd et al., 2021). In areas where railway rights of way are the predominant habitat for pollinators rights of way may act as an ecological trap concentrating populations in these habitats and making them more susceptible to disturbance (Gardiner et al., 2018). These types of habitats would have flowering plants throughout the application season for SLF as different plant species bloom throughout the growing season. In 2014 a Presidential Memorandum was signed that created a Federal strategy to promote the health of honeybees and other pollinators. A product of the memorandum was to create a pollinator health task force and develop a document entitled "National Strategy to Promote the Health of Honeybees and other Pollinators". The memo also directed EPA to work with state agencies to develop pollinator protection plans. All the states where mist blower treatments are proposed have developed various pollinator protection plans, except for Ohio, which is currently drafting a plan.

- Maryland (Maryland Pollinator Protection Plan.pdf)
- Pennsylvania (The Pennsylvania Pollinator Protection Plan (P4) — Department of Entomology (psu.edu))
- Virginia (BMP-plan.pdf (virginia.gov))
- West Virginia (West-Virginia-Pollinator-Protection-Plan_Final.pdf (wv.gov))

Most of the protection measures described in these plans refer to protection of honeybees but some of the measures may also provide protection for native pollinators. APHIS will follow these best management practices, where applicable and feasible, for protecting honeybees and native pollinators from SLF program insecticide applications. USEPA (2017) has also developed labeling recommendations focusing on the protection of acute risks to honeybees in managed areas that may have some applicability to native pollinators. Many of the measures described in the document refer to avoiding applications in and around blooming which is more difficult with non-agricultural pesticide applications such as the proposed SLF insecticide applications, due to variability in the blooming times for various plant species that would occur in railroad right of ways and adjacent native habitats.

In addition to the above plans, the SLF program uses risk reduction measures for pollinators in railway right of ways that can reduce risks to adjacent habitats that support pollinators. Wind speed restrictions during applications will reduce drift that may pose a risk to off-site pollinators.

Applying insecticides in the evening, when fewer pollinators will be foraging, may provide some level of protection; however, the SLF Program has limited flexibility regarding treatment times Treatment times are mainly determined by railway availability. In addition, the proposed mist blower insecticides have residual toxicity lasting greater than 24 hours so this mitigation measure may not be as effective as other measures in reducing risk to pollinators, especially those that are foraging within the treatment areas. Limiting the number of treatments applied to no more than 4 treatments per year could reduce risks to pollinators at the proposed treatment sites and adjacent off-site areas.

In addition to the above measures designed to protect pollinators there is also the Monarch Candidate Conservation Agreement with Assurances (CCAA) that was signed in March 2020. The CCAA encourages transportation and energy partners to participate in monarch butterfly conservation by protecting habitat in rights-of-way and associated lands in the lower 48 states. More than 45 energy and transmission companies and state departments of transportation are providing funding and other resources for monarch-friendly management practices on millions of acres in rights of way in the U.S. These efforts not only benefit the monarch but other native pollinators as well. The US Fish and Wildlife Service also maintains the monarch conservation database (MCD) that tracks ongoing and proposed projects (USFWS, 2021 Monarch Conservation Database | U.S. Fish and Wildlife Service (fws.gov)). Currently there are no projects in railroad rights of way enrolled in the program. However, most of the counties identified in this supplemental EA have at least one monarch conservation project planned or in progress at other sites. APHIS will work with stakeholders to identify locations of monarch conservation projects so that proposed mist blower treatments do not result in significant impacts due to off-site drift and runoff.

(1) *Migratory Bird Treaty Act*

Federal law prohibits an individual to pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, offer for sale, sell, offer to purchase, purchase, deliver for shipment, ship, cause to be shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird or any part, nest, or egg of any such bird (16 U.S.C. §§ 703-712; 50 CFR § 21). Some examples of anticipated disturbance associated with Program activities include the use of off-road vehicles and noise. However, the areas where mist blower treatments are proposed are subject to train noise and human activity and the use of mist blower applications would not likely cause additional disturbance. Also, beta-cyfluthrin is considered practically non-toxic to birds based on available acute, sub-acute, and chronic toxicity values (USEPA, 2013). Bifenthrin is considered slightly toxic to birds based on oral and dietary short-term toxicity testing (USEPA, 2010). Chronic toxicity to birds from both pyrethroid insecticides is considered low based on available data.

(2) <u>Bald and Golden Eagle Protection Act</u>

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. During their breeding season, bald eagles are sensitive to a variety of human activities. The U.S. Fish and Wildlife Service (USFWS) recommends buffer zones from active nests. USDA-APHIS will continue to meet the recommendations as described in the 2015 SLF EA for Berks, Lehigh, and Montgomery County (USDA-APHIS, 2015b) in every area where Program activities may occur. If bald or golden eagles are discovered near a Program action area, the State agency responsible for the area will contact the USFWS and implement recommendations for avoiding disturbance at nest sites. For bald eagles, USDA-APHIS will follow guidance as provided in the National Bald Eagle Management Guidelines (USFWS, 2007) to determine if they need to use the 330 to 660-foot buffer from an active nest, depending on the visibility and level of activity near the nest, or if they will need a permit.

(3) <u>Endangered Species Act</u>

Section 7 of the ESA and ESA’s implementing regulations require Federal agencies to ensure that their actions are not likely to jeopardize the continued existence of Federally-listed threatened and endangered species, or result in the destruction or adverse modification of critical habitat. USDA-APHIS initiated consultation with USFWS field offices in Maryland, Ohio, Pennsylvania, Virginia, and West Virginia for actions being proposed under the preferred alternative. To date, USDA-APHIS has received concurrence from USFWS for the proposed SLF Control Programs in Maryland, Ohio, and Pennsylvania. Federally-listed species in the Program area include bats, birds, amphibians, reptiles, fish, mussels, arthropods, and plants. USDA-APHIS has also begun consultation with the National Marine Fisheries Service (NMFS) for two fish species. USDA-APHIS will implement protection measures for Federally-listed species and critical habitat in each state and select counties prior to the initiation of Program activities. No program activities will occur in a state until consultation has been completed with the USFWS and NMFS.

The SLF Program has proposed implementing a minimum of a 500-foot no-treatment buffer adjacent to aquatic habitats occupied by federally listed species to reduce the potential of off-site runoff and drift of bifenthrin and beta-cyfluthrin insecticides applied using a ground-based mist blower application. This buffer should be adequate based on drift modeling done by USDA-APHIS using AgDrift® (USDA-APHIS, 2021; see appendix A).

3. Human Health and Safety

The public as well as SLF Program workers can be impacted by the application of herbicides and insecticides in the SLF Program. USDA-APHIS evaluated the potential human health and ecological risks from the proposed use of the herbicides triclopyr, imazapyr, and metsulfuron-methyl for the ALB Eradication Program, and found those risks to be low. The same human health risks will apply to the SLF Program (USDA-APHIS, 2018a). For complete assessment of risks to human health from application of triclopyr, imazapyr, and metsulfuron-methyl, see the ALB 2015 EA (USDA-APHIS, 2015a). Human health risks will also be low from the use of glyphosate and aminopyralid based on risk assessments prepared by USDA-Forest Service (FS). USDA-FS risk assessments have similar use patterns to those proposed for the SLF Program (USDA-APHIS, 2018a; USDA-FS, 2007; USDA-FS, 2011b).

Insecticides must be applied in a way that minimizes significant exposure to soil, water, air, and vegetation, to minimize exposure risks. Human health risks from insecticides applied via injection, trunk hand-held spray, and backpack spraying are expected to be negligible based on limited exposure from the proposed use pattern. No commodities will be harvested from treated trees, so there will be no dietary risks to humans.

B. bassiana, soybean oil, and dinotefuran are of low toxicity to humans. Imidacloprid has increased risks, but treatments are limited to injections on trap trees so risks exposures are minimized. Bifenthrin has low acute toxicity via the dermal route of exposure, moderate acute toxicity via the oral route, and is considered a possible human carcinogen (USEPA, 2017a). Low amounts of bifenthrin can cause adverse human health effects, including dermal and respiratory tract irritation and neurological symptoms (e.g., dizziness and altered sensations) (USEPA, 2010a). Beta-cyfluthrin has high oral and inhalation toxicity. Dichlorvos has numerous health risks, but there is little risk of exposure since the chemical is not being sprayed but used on strips placed in containers.

The use of mist blowers to spray bifenthrin and beta-cyfluthrin poses the greatest risks to humans when compared to other program actions. Workers applying pesticides as well as the public in areas that are in proximity to the proposed treatment sites, may be exposed. USDA-APHIS personnel and contractors are required to comply with all USEPA pesticide use requirements and meet all recommendations for PPE during insecticide application. Adherence to label requirements and additional SLF Program measures designed to reduce exposure to workers (e.g., PPE requirements include wearing a long-sleeved shirt, long pants, and shoes plus socks) and the public (e.g., mitigations to protect water sources, mitigations to limit spray drift, and restricted-entry intervals) decrease risk of exposure.

Pesticide drift and runoff increase potential exposure to the public around treatment areas. To ensure minimal impacts to those in proximity to mist blower treatment areas, it is extremely important to adhere to label mitigations. In addition, the following previously mentioned restrictions will be applied whenever using mist blowers, which will decrease risks:

- Do not apply when wind velocity exceeds 10 mph.
- Do not apply when wind direction favors downwind drift towards nearby water bodies.

- Do not treat areas to the point of run-off.

To further protect the public, any activities on private property will only occur with property owner and/or resident permission and awareness. Notification of all property owners and residents will occur within 1 mile of the treatment area in the following manner: in person, phone call, text, email, doorhanger, or a combination of these methods. It is possible that the SLF Program can adjust the treatment time, so applications are made when few or no people are in the vicinity. However, this mitigation will need to be done on a case-by-case basis. The SLF Program must work with the various railroad companies to obtain access to the railroads; therefore, treatments dates and times are not necessarily determined by the Program.

Pesticide Hypersensitivity

Applications with mist blowers, which spread droplets of insecticide further than the other application methods in the SLF Program, have the potential to impact surrounding individuals that have pesticide hypersensitivity. Additional buffers may be necessary to protect these individuals. The SLF Program standard protocol to notify all property owners and/or residents within 1 mile of the treatment area will also allow any pesticide hypersensitive individuals to contact the Program and/or take any protective measures necessary to protect themselves from nearby pesticide treatments.

The SLF Program will use available State data to locate pesticide hypersensitive individuals so they can adjust where pesticides are being sprayed and notify these people and their businesses. In Pennsylvania, the SLF Program can use information collected by the Pennsylvania Department of Agriculture (PDA). PDA maintains a registry of pesticide hypersensitive individuals. The registry lists the locations of people who have been verified by a physician to be excessively or abnormally sensitive to pesticides. Pesticide application businesses are required to notify individuals in the registry 12 to 72 hours in advance of pesticide application to an attached structure or outdoor above ground pesticide application within 500 feet of any listed location. See PDA's pesticide hypersensitivity page for more information: https://extension.psu.edu/pesticide-hypersensitivity-registry-and-application.

The Maryland Department of Agriculture and West Virginia Department of Agriculture both maintain a registry of pesticide sensitive individuals as well: https://www.marylandpest.org/aws/MSPCA/pt/sd/news_article/267149/_PARENT/layout_details/false; https://agriculture.wv.gov/wp-content/uploads/2020/05/Hypersensitivity-Letter-ApplicationKent.pdf. Ohio and Virginia do not appear to have similar registries. If no information is available online, the SLF Program will contact the State's environmental protection agency or agriculture agency. The SLF Program will comply with all State, County, and Local ordinances and authorities when providing notifications to address the needs of any surrounding pesticide hypersensitive individuals.

Organic Production

The control of SLF around organic fields is important; while traditional orchards and vineyards have various options for chemically treating trees and grape vines against SLF, effective treatment options for organic producers are minimal. *B. bassiana* is allowed for use by USDA as an organic pesticide (AgDaily, 2019 and 7 CFR part 205, National Organic Program) and has been shown to be effective against SLF (Clifton, et. al., 2020).

There are over 1,756 organic producers located within one-half mile from areas where bifenthrin and beta-cyfluthrin could be applied using mist blowers. To protect organic production in the treatment area, SLF Program must follow all labeled requirements that attempt to ensure the reduction of spray drift and runoff of the pyrethroids into organic fields, including using the appropriate nozzle size, buffers, and not applying when wind direction or velocity is not ideal. Even with all prescribed measures, drift onto organic fields could still occur, so PPQ will notify organic producers within a 1-mile distance of treated rail lines prior to any SLF mist blower treatments.

Some States in the mist blower treatment area endorse the use of the registry FieldWatch® (Pennsylvania, Ohio, and Maryland). The registry is free and voluntary. Pesticide and herbicide applicators can notify growers (and beekeepers) of spray applications through the system: https://pested.osu.edu/resources/Fieldwatch.

Apiaries

The SLF Program must protect local apiaries from chemical exposure within the treatment areas. The location and timing of bifenthrin and beta-cyfluthrin applications are of particular concern to honeybees. There are over 1,100 beekeepers within Pennsylvania and select counties of Ohio, Maryland, Virginia, and West Virginia where mist blowers could be used under the preferred alternative. Apiaries in the States of Maryland, Ohio, Pennsylvania, and West Virginia must be registered. While Virginia does not require an apiary to register, the State encourages participation in the online system BeeCheck^{TM} to facilitate communication between beekeepers, agricultural producers, and pesticide applicators (see https://va.beecheck.org/map). Beekeepers in Virginia and elsewhere can choose to display their apiary locations on the public BeeCheck^{TM} map site or limit access to agricultural producers and pesticide applicators. The SLF Program will work with the State Agriculture Department to notify apiaries of treatment activities along railways and at intermodal sites.

The State of Pennsylvania provides a best management practice document for beekeepers in the SLF quarantine area (Roccasecca, K., 2020). Beekeepers may need permits to move hives or equipment within a State and State apiarist may need to be contacted for information. Pennsylvania's best management practices advise beekeepers to avoid placing colonies or equipment under tree lines in an area with SLF since the hives and equipment may be more likely to contain SLF eggs. Beehives and equipment are often transported and could disperse SLF eggs. In addition, hives can become covered in a messy "honeydew", excreted by the SLF adults SLF.

Bifenthrin kill bees on contact during application and will continue to kill bees for one or more days after treatment (Krupke, C.H., et al., 2021). Beta-cyfluthrin product labels state that applications made directly to crops or weeds are highly toxic to pollinators, such as bees. The label also states not to make applications or allow drift to crops or weeds where bees are actively foraging. Various plant species occur in the use sites proposed for SLF treatments with different blooming periods throughout the treatment season for SLF. These sites will be evaluated prior to application to determine if bees and other pollinators are actively foraging. Per label requirements, applications will be avoided at sites where pollinators are foraging, or when conditions are favorable for drift to areas where pollinators are foraging.

The Program will consider chemically treating with hand-held or backpack sprayers when treatment areas are within proximity to apiaries. If not possible to spray with hand-held or backpack sprayers, bees should be moved from the area if bifenthrin or beta-cyfluthrin are used on plants the bees are visiting. A new site must be at least 3 miles away to prevent bees from returning to the old site (Krupke,C.H., et al., 2021). Applying insecticides in the evening, when fewer bees will be foraging, will also provide some protection to honeybees. However, the SLF Program has limited flexibility regarding treatment times; treatment times are mainly determined by railway availability.

4. Equity and Underserved Communities

In Executive Order (EO) 13985, *Advancing Racial Equity and Support for Underserved Communities Through the Federal Government*, each agency must assess whether, and to what extent, its programs and policies perpetuate systemic barriers to opportunities and benefits for people of color and other underserved groups. In EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,* Federal agencies must identify and address disproportionately high and adverse human health or environmental impacts of proposed activities. Federal agencies also comply with EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks*. This EO requires each Federal agency, consistent with its mission, to identify and assess environmental health and safety risks that may disproportionately affect children and to ensure its policies, programs, activities, and standards address the potential for disproportionate risks to children.

Under the preferred alternative, treatments along railways will increase. As previously mentioned, there are approximately 6,700 miles of railway in the areas where mist blowers could be used under the preferred alternative. While homes near commuter train stations tend to get more expensive, general online comments indicate home values tend to be less by railways due to noise, dangers surrounding pets and children being hit by trains, and diesel fuel and air pollution. A study in Memphis, Tennessee indicated residential properties exposed to 65 decibels or greater of railroad noise origin resulted in a 14 to 18 percent lower property value (Walker, 2016). It is reasonable to assume underserved populations may be more prevalent around certain railways, and this needs to be considered during SLF treatments. A study by the Mayo clinic connects existing health issues for populations near railways, specifically increases in children's asthma along railroads (Juhn, et.al., 2005).

According to EO 13985, SLF Program personnel must have meaningful engagement with locally impacted people whenever possible. USDA APHIS utilizes various databases and mapping tools to identify the locations of underserved populations in the treatment area. USDA APHIS has relied on the EPA environmental justice screening and mapping tool, EJSCREEN (see https://www.epa.gov/ejscreen), which can highlight areas that may require additional thought, research, and outreach regarding Program activities. EJSCREEN users choose a geographic area; the tool then provides demographic and environmental information for that area. The six demographic criteria that EJSCREEN uses to identify underserved populations include: percent low income, percent people of color, less than high school education, linguistic isolation, individuals under age 5, individuals over age 64. It must be noted that while EJSCREEN is very informative, there are substantial uncertainties in demographic and environmental data. Results should be supplemented with local knowledge. Using EJSCREEN, USDA APHIS identified the following areas of high concern for potential environmental impacts to underserved populations: Frederick County in Maryland; Loudoun County in Virginia; Forest, Monroe, Dauphin, Lehigh, Berks, Philadelphia, and Delaware counties in Pennsylvania. See figure 4, Percent of Vulnerable Populations in Chemically Treated Counties, for one of the EJSCREEN maps that APHIS generated for the SLF Program. Dark purple marks counties in the treatment areas with a high percent of minority and linguistic isolation. Special consideration needs to be given when outreach to these communities begins.

EJSCREEN can provide more detailed information, down to residential blocks, but more meaning files are difficult to share. Other databases that USDA APHIS uses provide detailed maps that may be more meaningful to the public, such as one developed by the Centers for Disease Control and Prevention (CDC) and the Agency for Toxic Substances and Disease Registry (ATSDR) using the Social Vulnerability Index (SVI) (see https://www.atsdr.cdc.gov/placeandhealth/svi/index.html). Social vulnerability refers to the potential negative effects on communities caused by external stresses on human health. CDC's SVI uses 15 social factors that are grouped into 4 major themes including socioeconomic status, household composition and disability, minority status and language, and housing type and transportation. Like EJSCREEN, maps generated by the CDC's SVI database can highlight areas that may require additional thought, research, and outreach regarding Program activities. See figure 5, an example SVI map for one of the treatment counties in Pennsylvania.

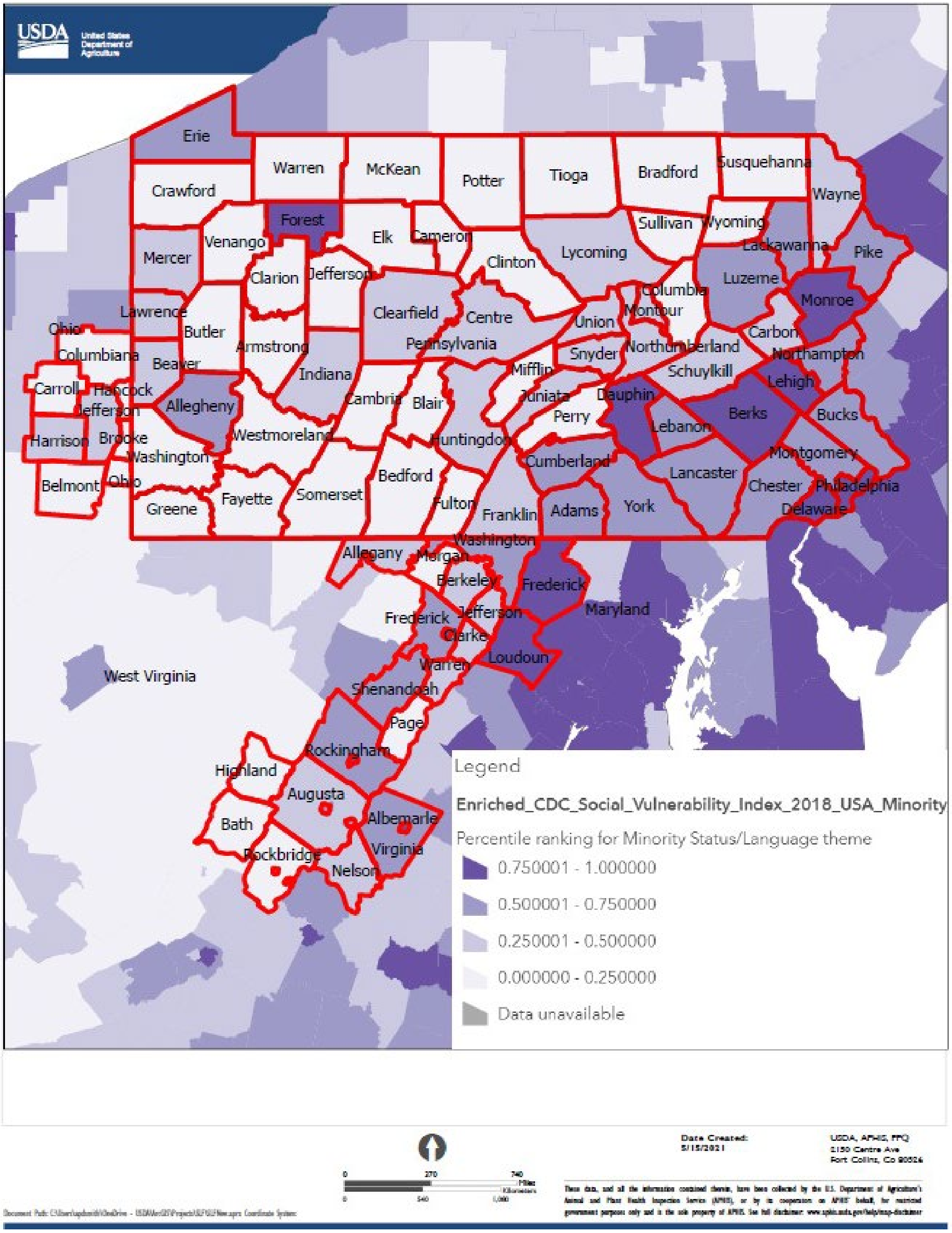
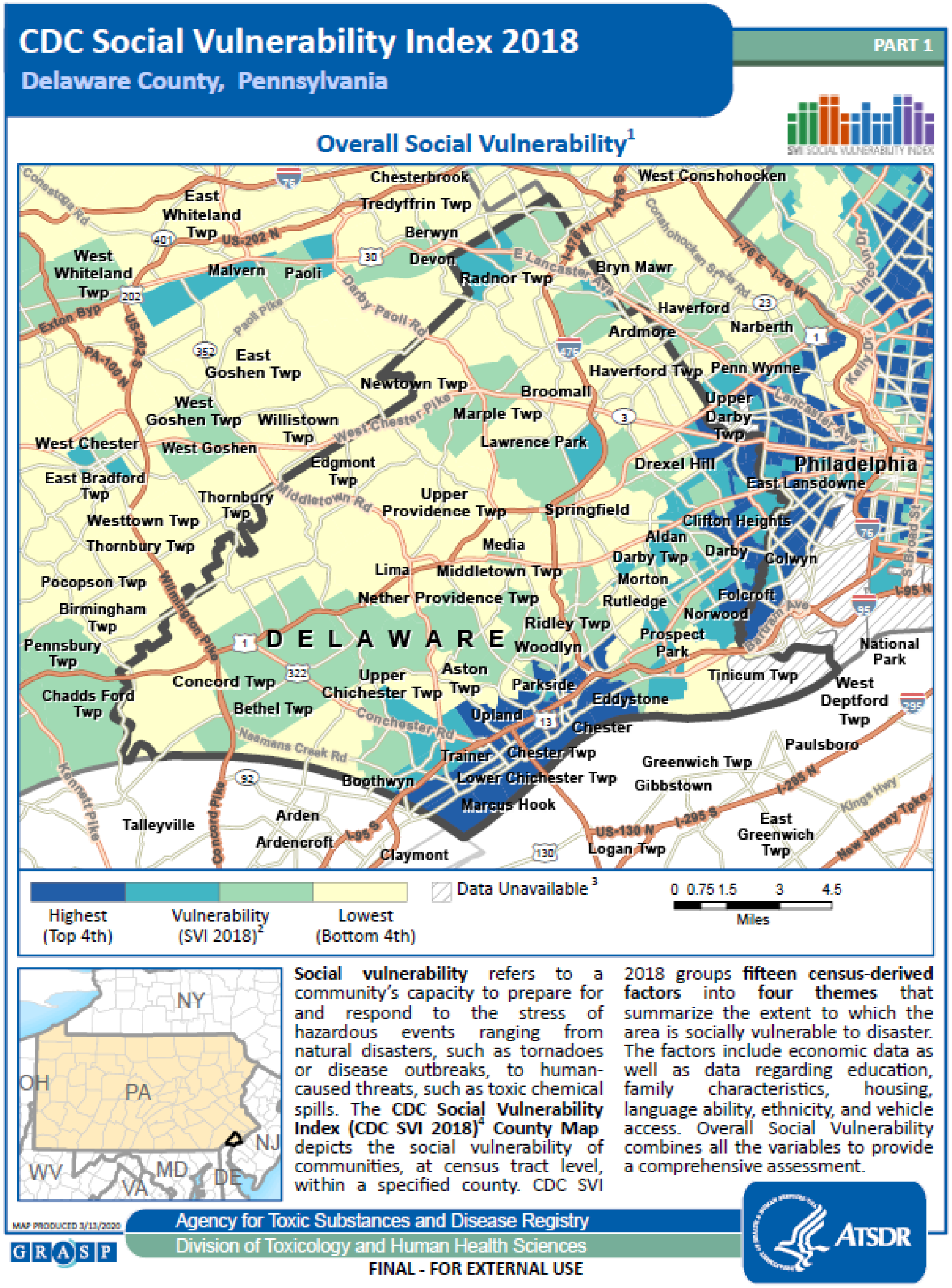


Figure 4. Percent of Vulnerable Populations in Chemically Treated Counties



CDC Social Vulnerability Index 2018

Delaware County, Pennsylvania

PART 1

Overall Social Vulnerability[1]

Highest (Top 4th)	Vulnerability (SVI 2018)[2]		Lowest (Bottom 4th)

▨ Data Unavailable[3]

0 0.75 1.5 3 4.5 Miles

Social vulnerability refers to a community's capacity to prepare for and respond to the stress of hazardous events ranging from natural disasters, such as tornadoes or disease outbreaks, to human-caused threats, such as toxic chemical spills. The **CDC Social Vulnerability Index (CDC SVI 2018)**[4] **County Map** depicts the social vulnerability of communities, at census tract level, within a specified county. CDC SVI 2018 groups **fifteen census-derived factors** into **four themes** that summarize the extent to which the area is socially vulnerable to disaster. The factors include economic data as well as data regarding education, family characteristics, housing, language ability, ethnicity, and vehicle access. Overall Social Vulnerability combines all the variables to provide a comprehensive assessment.

MAP PRODUCED 3/13/2020

GRASP

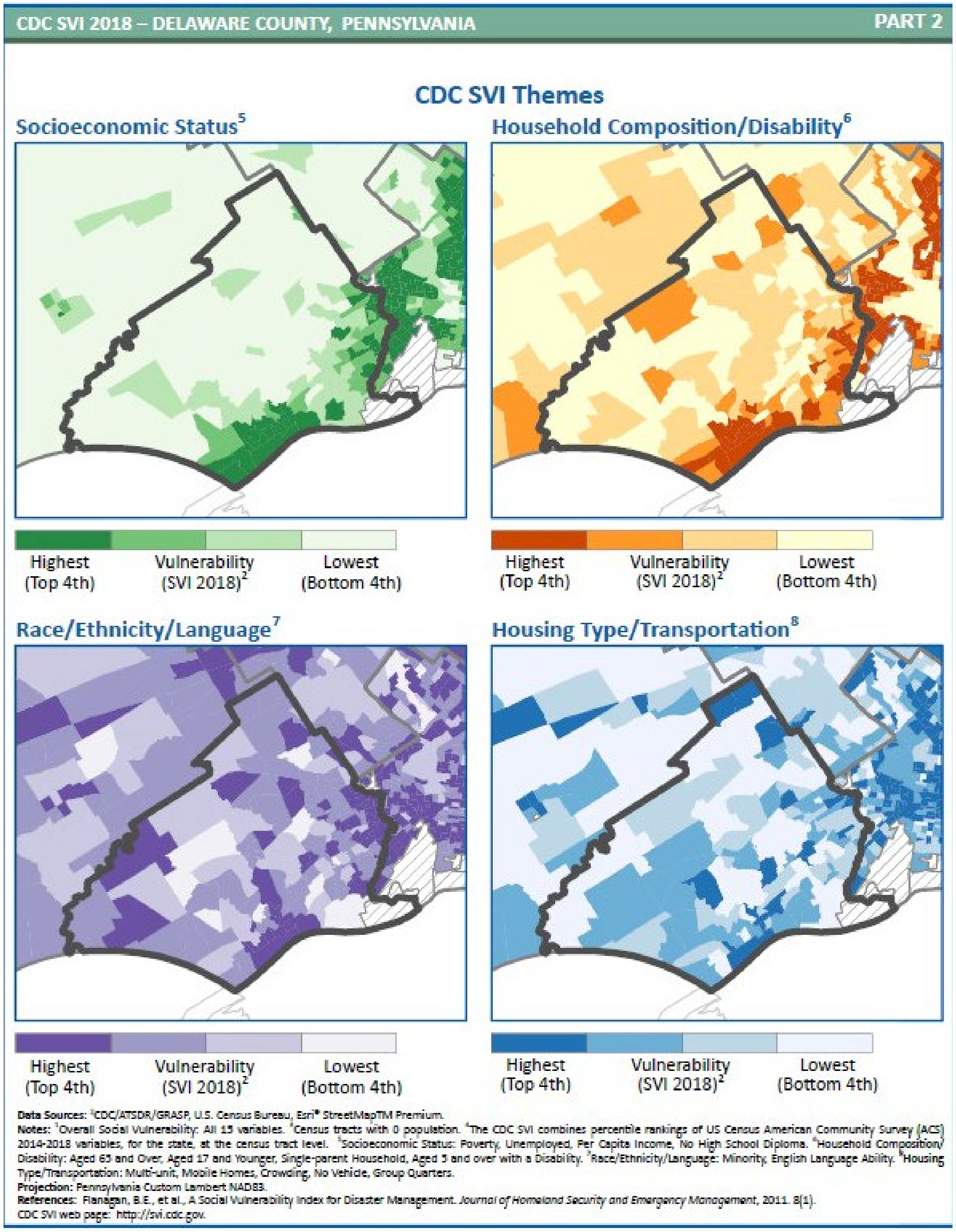
Agency for Toxic Substances and Disease Registry

Division of Toxicology and Human Health Sciences

FINAL - FOR EXTERNAL USE

ATSDR

Figure 5. CDC Social Vulnerability Index 2018, Delaware County Pennsylvania



Data Sources: [1]CDC/ATSDR/GRASP, U.S. Census Bureau, Esri® StreetMapTM Premium.

Notes: [1]Overall Social Vulnerability: All 15 variables. [2]Census tracts with 0 population. [3]The CDC SVI combines percentile rankings of US Census American Community Survey (ACS) 2014-2018 variables, for the state, at the census tract level. [5]Socioeconomic Status: Poverty, Unemployed, Per Capita Income, No High School Diploma. [6]Household Composition/Disability: Aged 65 and Over, Aged 17 and Younger, Single-parent Household, Aged 5 and over with a Disability. [7]Race/Ethnicity/Language: Minority, English Language Ability. [8]Housing Type/Transportation: Multi-unit, Mobile Homes, Crowding, No Vehicle, Group Quarters.

Projection: Pennsylvania Custom Lambert NAD83.

References: Flanagan, B.E., et al., A Social Vulnerability Index for Disaster Management. *Journal of Homeland Security and Emergency Management*, 2011. 8(1).

CDC SVI web page: http://svi.cdc.gov.

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Figure 6. Continued CDC Social Vulnerability Index 2018, Delaware County Pennsylvania

With USDA-APHIS' oversight and guidance, State and local agencies will reach out to all landowners and residents adjacent to spraying areas. Every property owner and resident, regardless of whether they have been identified as being part of an underserved population, will be notified via phone, text, email, doorhanger, in person communication, or some combination of these methods. With the assistance of local authorities, special consideration will be given by the SLF Program to any underserved populations in the treatment areas to ensure meaningful engagement about the treatments has occurred.

Protective measures on labels are meant to safeguard not only the applicator, but the public as well, including children. All labels will be followed. Previously mentioned restrictions, such as limiting applications when wind speed above 10 mph, limiting applications due to wind direction, not treating vegetation to the point of runoff, will all decrease potential exposure of underserved communities and children through drift and runoff. There are over 3,500 schools one-half mile from where mist blowers could be used under the preferred alternative. There will also be playgrounds and parks within proximity to areas treated with mist blowers. The use of mist blowers to spray bifenthrin and beta-cyfluthrin pose the greatest potential impact to children. It would be preferrable for the Program to chemically treat with hand-held or backpack sprayers when treatment areas are within proximity to schools, parks, and playgrounds. Treatments will primarily be during summer months when most school children are not on school grounds. Regardless of application method or when treatments occur, the SLF Program will not apply pesticides during school hours and will notify all schools regarding upcoming applications. The SLF Program will work closely with school officials to mitigate impacts to school aged children. The SLF Program will work with ground staff and city/municipal authorities prior to treatments at parks to limit access to areas or during off-hours. Sections of park may require closures.

5. Tribal Consultation and Coordination

Executive Order 13175 "Consultation and Coordination with Indian Tribal Governments," calls for agency communication and collaboration with Tribal officials for proposed Federal actions with potential Tribal implications. The Archaeological Resources Protection Act of 1979 (16 U.S.C. §§ 470aa-mm), secures the protection of archaeological resources and sites on public and Tribal lands. In 2020, USDA-APHIS provided each Federally-recognized Tribe in proposed SLF Program area (the Mid-Atlantic States: Connecticut, Delaware, Maryland, New York, New Jersey, Pennsylvania, Virginia, West Virginia, and the District of Columbia; as well as North Carolina, Ohio, and Kentucky) with a letter, explaining the preparation of the June 2020 EA, detailing the proposed action alternatives, and stating that the agency believed the preferred alternative was unlikely to affect Native American sites and artifacts. Tribes were provided with USDA-APHIS contact information should they have any questions or concerns regarding the SLF Program.

The current SLF Program proposed action would only change actions in Pennsylvania and select counties in Maryland, Ohio, Pennsylvania, Virginia, and West Virginia. USDA-APHIS sent notification of the proposed action changes to Federally-listed Tribes in those areas. USDA-APHIS believes the preferred alternative is unlikely to affect Native American sites and artifacts. USDA-APHIS will offer each Tribe the opportunity to consult with the Agency. Consultation with local Tribal representatives will occur prior to the onset of Program activities to fully inform the Tribes of possible actions the Agency may take on or near Tribal lands. If USDA-APHIS discovers any archaeological Tribal resources, it will notify the appropriate individuals.

6. Historic and Cultural Resources

The National Historic Preservation Act of 1966, as amended (16 United States Code (U.S.C.) §§ 470 et seq.), requires Federal agencies to consider the potential for impacts to properties included in, or eligible for inclusion in the National Register of Historic Places (36 C.F.R. §§ 63 and 800) through consultation with interested parties where a proposed action may occur. This includes districts, buildings, structures, sites, and landscapes. There are over 2,800 historic properties in the areas where mist blowers could be used under the preferred alternative. USDA-APHIS will ensure that the preferred alternative will not alter, change, modify, relocate, abandon, or destroy any historic buildings, edifices, or nearby infrastructure. USDA-APHIS anticipates that herbicides and insecticides applied in the vicinity of historic buildings and other anticipated program actions will not directly affect the buildings or their properties.

D. Comparison of Three Alternatives

While USDA-APHIS will not take actions against SLF under the no treatment alternative, other government agencies and private landowners may act. The agency anticipates less actions under the no treatment alternative; however, it is possible that environmental impacts could increase if actions taken by others are not well advised or properly coordinated. Additionally, impacts from SLF damage on host trees, orchards, vineyards, and forests, are expected to increase.

The no action and preferred alternative will increase the level of human activities around the treatment area, which can, to varying degrees, impact ground vegetation, soil compactions, and noise levels. By utilizing best management practices, USDA-APHIS can minimize these impacts on humans and the environment.

There are over 6,700 miles of railway and 980 intermodal facilities that could potentially be treated with bifenthrin or beta-cyfluthrin using mist blowers. There are various places of concern that line the treatment area, everything from waterbodies and wetlands to public land use areas, schools, organic producers, homes, honeybee hives, and historic properties. Spray drift and runoff into these areas must be minimized to protect air, water, soil quality; human health; and wildlife. See table 5 for a summary of areas of concern.

Table 5. Summary of extent of treatment and nearby areas of concern

State	Railways (miles)	No. of Intermodal Facilities	*No. of waterbodies & wetland	*No. of public land use areas	*No. of schools	*No. of organic producers	**No. of homes	**No. of bee keepers	*No. of historic properties
MD counties	440	19	89	21	132	33	133,174	162	104
OH counties	490	2	66	13	99	18	376,248	140	72
PA-statewide	5,130	942	1,737	121	2,951	1,644	5,732,628	556	2,401
VA counties	456	14	686	21	243	58	191,990	269	181
WV counties	193	4	84	11	97	3	129,824	20	205
Total	**6,709**	**981**	**2,662**	**187**	**3,522**	**1,756**	**6,563,864**	**1,147**	**2,963**

*Within ½ mile from railways to be treated with mist blower applications.

**Within the State or select counties where mist blower treatment will occur.

If mist blowers are applied per the pesticide label, with all the additional protective mitigations described throughout the document, impacts to soil, water, and air quality are not expected to be significant. Soil disturbance related to program activities will be short-term. The treatment areas are highly managed and disturbed habitats that receive routine railway traffic and other mechanical and chemical treatments to manage unwanted vegetation. Current and future activities related to urbanization, agricultural activities, logging, and roadway construction appear more likely to significantly impact environmental quality than the program.
Vehicle emissions associated with getting to and from project sites will be minor relative to the ongoing and future emissions from urbanization, highway traffic, and agricultural production. Any increases in air pollutants associated with program activities and vehicle emissions will cease upon completion of program activities at each site. The contribution from the preferred alternative will remain minor compared to the overall emissions in the program area.

USDA-APHIS expects the potential human health impacts related to the preferred alternative to be minimal, and in the context of potential cumulative impacts to past, present, and future activities, these impacts will be incrementally minor. The greatest sector of the human population at risk of exposure to herbicides and pesticides are program workers and applicators; however, these risks are minimized with PPE. To preserve environmental quality for ecological resources, potentially negative cumulative impacts are minimized throughout the preferred alternative by following best management practices and training personnel to reduce or avoid adverse impacts to pollinators, eagles, migratory birds, threatened and endangered species, and the surrounding environment.

Table 6 summarizes the potential human health and environmental impacts from each of the three alternatives for a quick comparison.

Table 6. Comparison of Potential Human Health and Environmental Impacts

Control Measure	No Action	No Treatment	Preferred
Herbicides	Minimal impact to human health and environment if labels followed	Potentially less use of herbicides than no action and preferred alternative and less impacts	Identical to no action. Minimal impact to human health and environment if labels followed
Insecticides	Soybean oil and *B. bassiana* - extremely low potential for human health and environmental impacts. Dinotefuran and imidacloprid – method of application keeps human health and environmental impacts to a minimum Bifenthrin and beta-cyfluthrin- potential for human and environmental toxicity issues. Minimal impacts if products are used according to label	Potentially less use of insecticides than no action and preferred alternative and less impacts	Increase in potential human health and environmental impacts and impacts to pollinators due to use of mist blowers. Impacts will be minimal if labels followed and additional buffer to waterbodies is used
Traps	Extremely low impact to human health and environment.	Potentially even less impacts than no action since use of fewer traps is anticipated	Identical to no action. Extremely low impact to human health and environment.
Surveys and Egg Mass Scraping	Extremely low impact to human health and environment	Potentially less impacts than no action since there may be less use of surveys and egg scraping	Identical to no action. Extremely low impact to human health and environment

IV. Listing of Agencies Consulted

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

Plant Protection and Quarantine
Plant Health Programs
Animal and Plant Health Inspection Service
U.S. Department of Agriculture
4700 River Road, Unit 150
Riverdale, MD 20737

National Marine Fisheries Service
Office of Protected Resources
510 Desmond Drive SE Suite 103
Lacey, WA 98503

U.S. Fish and Wildlife Service
West Virginia Ecological Services Field Office
90 Vance Drive
Elkins, WV 26241-9475

U.S. Fish and Wildlife Service
Pennsylvania Ecological Service Field Office
110 Radnor Road, Suite 101
State College, PA 16801-7987

U.S. Fish and Wildlife Service
Chesapeake Bay Ecological Services Field Office
177 Admiral Cochrane Drive
Annapolis, MD 21401-7307

U.S. Fish and Wildlife Service
Virginia Ecological Services Field Office
6669 Short Lane
Gloucester, VA 23061-4410

U.S. Fish and Wildlife Service
Ohio Ecological Services Field Office, Suite 104
4625 Morse Road
Columbus, OH 43230-8355

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Appendix A. Aquatic ecological risk assessment for the application of bifenthrin and β-cyfluthrin using mist blower treatments for spotted lanternfly.

Introduction

The purpose of this risk assessment is to evaluate the risk to aquatic resources from the use of bifenthrin and β-cyfluthrin using mist blowers to treat for the Spotted Lanternfly (SLF), *Lycorma delicatula*. Applications are proposed along railway rights of way and intermodal facilities. USDA-APHIS is proposing a 150-ft. no-application buffer from all waterbodies within the proposed action area to protect human health and ecological resources from the risk of either insecticide. Waterbodies include, but are not limited to lakes, reservoirs, rivers, permanent streams, wetlands, natural and manmade ponds, and estuaries. USDA-APHIS is also proposing a 500-ft. no-application buffer from habitat, including designated critical habitat, for all federally listed aquatic species that may occur within the proposed action area.

This risk assessment evaluates how the USDA-APHIS proposed buffers, other program measures, and label restrictions may impact aquatic resources. The methods used in this risk assessment are consistent with methods used to evaluate the risk of chemicals, and in particular pesticides (USEPA, 1998; USEPA, 2004; USEPA, 2020a).

Exposure Analysis

This section of the risk assessment summarizes the use pattern, environmental fate, and chemistry data for bifenthrin and β-cyfluthrin. This section also estimates environmental residues in aquatic resources that could occur from the proposed mist blower applications.

Use Pattern

Applications of bifenthrin and β-cyfluthrin will be made using mist blower applications that are intended to create a small droplet size to increase efficacy because the mode of action is primarily as a contact insecticide. The label for bifenthrin (Talstar® P (EPA Reg. No. 279-3206)), allows treatment rates of 1.0 fluid ounce (fl. oz.) per 1,000 square feet (sq. ft.) or 43.5 fl. oz. per 100 gallons. For bifenthrin the maximum allowable application rate per acre is 0.22 pounds active ingredient per acre (lb. a.i./ac.) with a minimum application interval of 28 days based on the Talstar® P label. The label for β-cyfluthrin (Tempo® SC (EPA Reg. No. 432-1363)) allows a treatment rate of 0.54 fl. oz. per 1,000 sq. ft. For β-cyfluthrin the maximum allowable application rate per acre is approximately 0.183 lb. a.i./ac. with a minimum application interval of seven days. The number of applications that will occur at a site will range from one to four applications for either insecticide dependent upon the density of SLF and resources available for additional applications.

USDA-APHIS will implement the below mitigation measures listed below that are either on the label or are proposed as part of the SLF program to reduce the likelihood of drift and runoff to aquatic resources.

- Avoid mist blower applications at wind speeds greater than 10 mph.
- Use a 150-ft. no-application buffer from all waterbodies.
- Use a 500-ft. no-application buffer from all waterbodies that are habitat for federally listed aquatic species, including designated critical habitat.
- Avoid applications when rain events are expected within 24 hours prior to application.
- Avoid applications when the predominant wind direction is blowing toward a waterbody.

Treatments for SLF will be made as spot treatments, with the size of the treatment area ranging from 0.5 to 50 acres. The distance of maximum projection from a mist blower is 100 feet vertically, although SLF vegetation is approximately 30 feet. Applications are anticipated to occur at 75% of the actual height of the vegetation due to mist droplets moving up into the top of treated vegetation. The distance of maximum projection from a mist blower is 160 feet horizontally in an open area with no vegetation to intercept spray. Operationally, most treatments will be conducted as close as possible to the targeted vegetation with most vegetation within 30 ft. of the railroad track. A maximum of two swaths will be applied along rail lines if vegetation is present on either side of the tracks. If vegetation is present on only one side of the rail line, then only one swath would be applied. The timing of the applications will occur between April and October to coincide with nymphal emergence through the adult stage of SLF.

Chemical and Environmental Fate Properties

Bifenthrin and β-cyfluthrin are pesticides that belong to the pyrethroid insecticide class (figure 1). Pyrethroid insecticides are synthetic analogues of pyrethrins which are derived from flower heads of *Chrysanthemum cinerarieaefolium* and/or *C. cineum* (Spurlock and Lee, 2008). Pyrethroid insecticides act as neurotoxins by reacting with voltage-gated sodium channels in neurons. They have broad spectrum activity against a variety of invertebrate pests resulting in a wide variety of agricultural and non-agricultural use patterns in the United States. Bifenthrin and β-cyfluthrin are registered for various agriculture, commercial structural and landscape, and home and garden uses (Spurlock and Lee, 2008).

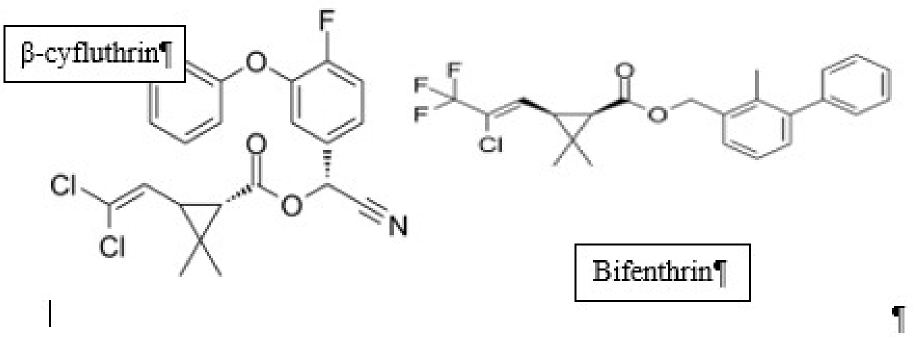

Figure 1. Chemical structure for β-cyfluthrin and bifenthrin.

Bifenthrin and β-cyfluthrin exhibit chemical and fate properties that suggest residues in the aquatic environment will occur primarily in the bound phase to soil particles and organic matter that are transported via runoff, or partition to total suspended solids and sediments from offsite drift into waterbodies (table 1) (USEPA, 2012; 2016). Water solubility is low for both insecticides with corresponding high soil adsorption coefficients (Koc) in various soil types. Vapor pressure and Henrys Law constant values suggest that bifenthrin and β-cyfluthrin will not volatilize from soil or water into the atmosphere in significant amounts. Both insecticides have high log-octanol water partition coefficients (Kow) suggesting they are lipophilic and may accumulate in nontarget organisms.

Table 1. Chemical and environmental fate properties for bifenthrin and β-cyfluthrin.

Chemical Fate Parameter	**Bifenthrin**	**β-cyfluthrin**
Molecular weight (g/mole)	422.9	434.29
Vapor pressure (mm Hg)	$1.8x10^{-7}$	$1.5x10^{-8}$
Henry's Law Constant (25°C) Atm*m^3/mole	$7.2x10^{-3}$	$3.7x10^{-6}$
Log-octanol water partition coefficient (log Kow)	6.4	6.2
Solubility (mg/L)	$1.4x10^{-4}$	$2.3x10^{-3}$
Hydrolysis half-life (days)	Stable	Stable at pH 5 and 7; 2.1 at pH 9
Soil photolysis half-life (days)	147 cyclopropyl 98.5 phenyl labels	5.6

Chemical Fate Parameter	**Bifenthrin**	**β-cyfluthrin**
Aqueous Photolysis half-life (days)	49	4.5
Koc (L/kg-organic carbon)	131,000 to 302,000	73,484 to 184,864
Aerobic soil metabolism half-life (days)*	169.2	72.68
Aerobic aquatic metabolism half-life (days)*	466.2	44.58
Anaerobic aquatic metabolism half-life (days)*	650.2	25.59
Foliar half-life (days)	35	Not reported

*Values represent 90th percentile estimates using the following equation: $t_{input} = t_{1/2} + t_{90,\, n-1}s / \sqrt{n}$.

Bifenthrin degradation under anaerobic conditions is comparatively much slower compared to β-cyfluthrin. Laboratory values have been confirmed in an outdoor wetland study where dissipation half-lives for bifenthrin in sediments were reported as 1,733 days, or as stable (Budd et al., 2011). Gan et al. (2005) reported bifenthrin aquatic aerobic and anaerobic half-life values in outdoor stream channels ranging from 436 to 1,950 days, and 251 to 498 days, respectively.

Degradation rates for bifenthrin and β-cyfluthrin typically follow a first-order decay rate, *k* (Meyer et al., 2013):

$$t1/2 = \ln(2)/k$$

Rapid dissipation of bifenthrin and β-cyfluthrin from water to sediments and other sources of organic matter has been measured in various laboratory and field studies in freshwater and marine systems. Pennington et al. (2014) reported a 50% reduction in nominal bifenthrin concentrations one hour after dosing mesocosm tanks simulated to represent a saltwater marsh environment. Bennett et al. (2005) measured dissipation in vegetated freshwater agricultural ditches dosed with bifenthrin. Dissipation appears to be bi-phasic with 98.3% removal of bifenthrin from the water column within 24 hours after dosing and reductions occurring at a slower rate after 24 hours (figure 2).

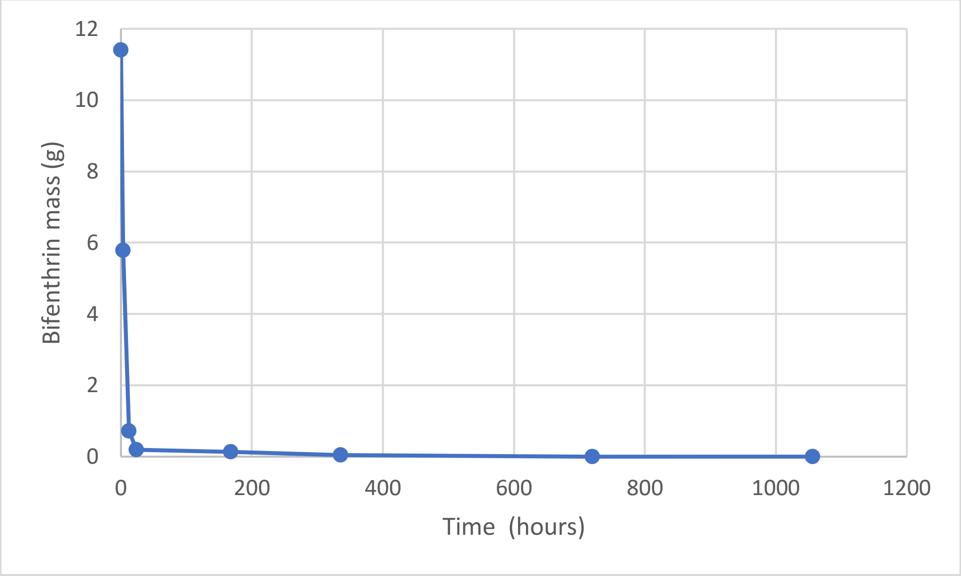

Figure 2. Aquatic dissipation curve for bifenthrin (Bennett et al., 2005).

Similar rapid dissipation in the water column has been observed for cyfluthrin in retention ponds and constructed wetland systems (Moore et al., 2009). Cyhalothrin aquatic dissipation was approximately 89% in retention ponds, and between 91 to 98% in constructed wetlands 24 hours after dosing. Similar rapid aquatic dissipation rates have been observed in other field studies using other pyrethroid insecticides. Maund et al. (2008) reported dissipation half-lives ranging from less than 0.13 days to 1.2 days in various indoor and outdoor microcosm/mesocosm studies for lambda-cyhalothrin.

Degradation or transformation products of β-cyfluthrin include permethric acid or DCVA (3-(2,2, -dichlorvinyl)-2,2-dimethyl-cyclopropanecarboxylic acid), FPB-ald (4-fluroe-3-phenoxybenzaldehyde), and FPB-acid (4-fluoro-3-phenoxybenzoic acid). DCVA and FPB-acid have low to moderate mobility in soil based on the available range of Koc values (USEPA, 2016). These metabolites are considered less toxic due to the loss of their neurotoxic mode of action (USEPA, 2016). Bifenthrin degradation products are minimal due to longer half-lives measured in various laboratory studies.

Estimated environmental concentrations in aquatic habitats

Off-site transport of insecticides during and after application typically occurs through volatilization, runoff, and drift. Chemical properties for bifenthrin and β-cyfluthrin suggest that volatilization of either insecticide will not be a major pathway of exposure to aquatic resources. Reported low vapor pressure values for bifenthrin and β-cyfluthrin suggest that transport from volatilization would be negligible (table 1).

Transport of bifenthrin and β-cyfluthrin to aquatic resources via runoff

The off-site transport of bifenthrin and β-cyfluthrin from runoff to waterbodies is anticipated to be very low for the proposed SLF mist blower applications. Previously described program and label restrictions, including buffer zones, and wind direction and weather-related application restrictions, will provide reductions in environmental loading to areas between the area of application and waterbodies. Residues of bifenthrin or β-cyfluthrin that may be washed from treated foliage after application would be minimal. Applications prior to rain events will be avoided to reduce the likelihood of runoff of pyrethroid insecticides from treated plants or soil. Pyrethroid residues that are removed by a rain event would partition to soil organic matter or soil particles reducing the likelihood of transport to waterbodies. The partitioning to soil and organic matter is supported by laboratory studies where Koc values for both pyrethroid insecticides typically exceed 100,000 suggesting strong adsorption to soil particles in various soil types. Pyrethroid residues bound to soil are less likely to be transported through runoff to waterbodies compared to residues that would occur in the dissolved phase. The use of a 150-ft. or 500-ft. no-application buffer would also reduce the transport of either pyrethroid insecticide to waterbodies from runoff.

Buffer zones have been shown to be effective in removing pesticides from runoff. The effectiveness of buffer zones depends on the chemical fate of a pesticide and site conditions such as soil type, ground slope, and other site attributes. Hatfield et al. (1995) demonstrated that grassed filter strips ranging from 40 to 60 ft. removed 10 to 40% of the herbicides atrazine, cyanazine, and metolachlor, which are all soluble in water. Arora et al. (1996) found that a 66-foot-wide riparian buffer on a 3% slope removed anywhere from 8 to 100% of the herbicides atrazine, metolachlor, and cyanazine during storm events. The variability in pesticide retention within the buffer zone was related to the amount of runoff during storm events. In a review by Neary et al. (1993), buffers of approximately 50 ft., or larger were effective in reducing pesticide runoff to water bodies. Syverson and Bechmann (2004) demonstrated that with an approximate 15-foot-wide buffer, sediment-bound residues of glyphosate, fenpropimorph, and propiconazole were reduced 39, 71, and 63%, respectively. Removal efficiency of soluble fractions of each product was 24 to 70% for glyphosate, 32 to 78% for propiconazole, and 61 to 73% for fenpropimorph. These types of removal efficiencies have been observed for other pesticides as well, such as 2,4-D and trifluralin (Lacas et al., 2005). Asmussen et al. (1977) documented 70% reductions in 2,4-D levels, while Rhode et al. (1980) demonstrated a 94% reduction in the herbicide trifluralin, which has a relative higher binding affinity, using grassed buffers of 24.4 meters (m). Equivalent buffer distances have been established for trapping sediment, which would suggest that pesticides that sorb to sediment would also be reduced with similar sized buffer zones (Wenger, 1999; Gril et al., 1997). Runoff of bifenthrin and β-cyfluthrin in irrigated field plots have been shown to be negligible after collection and analysis of samples at field edges. Hanzas et al. (2011) reported negligible transport of bifenthrin and β-cyfluthrin at the edge of turf plots that were irrigated at normal levels and were overirrigated after a simulated storm event. Runoff from plots with normal irrigation ranged from 0.003 to 0.006% of the total amount of bifenthrin and 0.010 to 0.011% for β-cyfluthrin after a 1.9 centimeters per hour (cm/h) simulated rainfall event. Transport in runoff from the over irrigation plots ranged from 0.052 to 0081% for bifenthrin and 0.23 to 0.58% for β-cyfluthrin. The above study did not factor the use of buffer zones which would further reduce the potential for bifenthrin and β-cyfluthrin runoff into waterbodies.

Currently there are no environmental fate pesticide simulation models to determine how buffers and other mitigation measures reduce runoff. The environmental fate of bifenthrin and β-cyfluthrin and implementation of the proposed aquatic mitigation measures for the SLF program suggest that negligible residues of either insecticide would occur in waterbodies from runoff.

Transport of bifenthrin and β-cyfluthrin to aquatic resources via drift

The use of a mist blower for bifenthrin and β-cyfluthrin applications suggest that drift will be the primary pathway of exposure to aquatic resources. Measures to reduce drift such as no-treatment buffer zones, wind direction restrictions, and other measures that will reduce drift from the proposed mist blower applications will be implemented by the SLF program.

Interception of off-site drift by vegetation can also reduce the potential for insecticide transport to waterbodies. Hancock et al. (2019) reported an approximate 96% reduction in instream malathion residues when comparing vegetated and non-vegetated sites. Vegetation between the spray block and the sensitive habitat as well as vegetation at the sensitive site can intercept drift and reduce exposure to aquatic and terrestrial habitats (Dabrowski et al., 2005; Dabrowski et al., 2006; Brown et al., 2004; Longley et al., 1997a,b; Ucar and Hall, 2001). Shallow, isolated. aquatic habitats have been shown to have aquatic and riparian vegetation with canopy coverage ranging from 41 to 81% which may also act to intercept drift (Beechie et al., 2005; Morley et al., 2005). Riaz et al. (2017) evaluated the effects of various aquatic plant species on bifenthrin removal from the water column. Removal efficiencies were 76, 68. and 70% for *Eichornia crassipes*, *Pistia strateotes*, and algal species (*Chaetomorpha sutoria*, *Sirogonium sticticum,* and *Zygnema* sp.), respectively.

Interception of drift by vegetation from the proposed mist blower treatments will be greatest for those waterbodies that are perpendicular to the rail line rights of way. These areas will only receive treatments if vegetation is present that could support SLF populations but treated vegetation would also serve to intercept drift and reduce transport to waterbodies. Waterbodies that occur under rail lines or where there is no substantive vegetation between the treatment area and protected resource would benefit less from interception of drift by vegetation. Riparian areas present along most waterbodies would remove drift as well.

The method of calculating aquatic exposure concentrations and effective buffer zones for the SLF program was done using the drift deposition model AgDrift. AgDrift allows for specific application information to be used as input into the model, and then determine the amount of drift that would occur at a user-defined distance from the spray block. The difference between deposition at the edge of a field and a selected buffer zone can be used to reduce the total amount of insecticide that would be expected at a certain distance from the spray block. Buffer zones can be established, based on the reduction in exposure to levels that would not be expected to result in direct or indirect effects to individuals, populations, or species.

AgDrift is a model that was developed from another drift model, AgDisp, that was developed by the USDA-Forest Service in the early 1980's (Hewitt et al., 2002; Teske and Curbishley, 2003). The AgDrift model has become a regulatory tool used by the U.S. Environmental Protection Agency (USEPA), Office of Pesticide Programs in estimating pesticide drift. Both models have a tiered approach that allows the user to choose default values or provide more specific data, based on the available information. Both models have been validated under various application scenarios in the literature (Duan et al., 1992a; Duan et al., 1992b; Teske et al., 2000; Teske and Thistle, 2004). In general, application predictions slightly underestimate drift within the first 80 m, but overpredict it at increasing distances by a factor of two to four at distances up to approximately 300 m (Bird et al., 2002; Duan et al., 1992a,b; Teske and Thistle, 2003; Thistle et al., 2008).

For this risk assessment, the AgDrift model was used to simulate potential drift from mist blower applications. AgDisp does not have a scenario for the use of mist blowers. Input data for the AgDrift model were based on pesticide labels for each product and SLF-specific information about other mitigation measures. Multiple factors can influence pesticide drift; however, release height, wind speed and direction, and nozzle atomization and orientation are the primary factors influencing drift (Bird et al., 1996; Teske et al., 2000).

The tier one orchard/airblast simulation was selected to estimate the effects of application buffers on drift. The user has limited ability to modify the variables and assess how they impact drift for the orchard/airblast simulation. AgDrift offers two mist blower application options to estimate drift. The mist blower application for grapefruit orchards was selected because it most closely approximates the height of vegetation that may be treated for SLF. The average height of vegetation for treatment under this use scenario in AgDrift is 15 ft. The height of treatment for SLF vegetation is approximately 30 ft.; however, mist blowers can apply up to 100 ft. Applications are anticipated to occur at 75% of the actual height of the vegetation due to mist droplets moving up into the top of treated vegetation. AgDrift has a default leaf area index of 2.77 that accounts for interception of mist blower droplets due to vegetation. The leaf area index is the ratio of upper leaf surface area to ground area. This value will vary at different SLF treatment areas. The average height of treatment for SLF vegetation is unknown; however, the mist blowers can apply up to 100 ft. AgDrift may underestimate drift values based on the use of higher application rates for SLF. Applications at the maximum capability for mist blowers would occur only in cases where individual trees are at that height and would not occur over an entire swath length. Because applications are occurring along rail line rights of way the swath range was selected to cover two tree rows under the mist blower simulation in AgDrift. The default setting is 20 rows; however, the SLF applications will not be applied over an area that large in a continuous spray block. Applications will occur in a linear fashion following the railroad tracks, except for intermodal areas which are considered an industrial use site.

AgDrift assumes that wind direction during application is blowing toward the waterbody to be protected (figure 3). The wind direction under the orchard/airblast tier cannot be modified. Therefore, it does not account for the program measure to avoid applications when the predominant wind direction is toward the habitat to be protected. In addition, applications for SLF would typically occur at wind speeds of 5 mph or less which is less than the default 10 mph wind spend used in AgDrift.

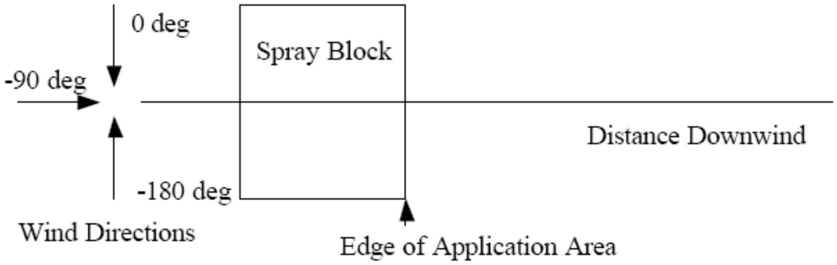

Figure 3. Wind direction relative to the spray block and the distance downwind (Teske and Curbishley, 2003).

AgDrift also does not account for environmental fate of pesticides or the cumulative residues that may result from multiple applications. For this application the maximum use rates for bifenthrin and β-cyfluthrin were used to estimate potential acute residues in waterbodies. The default volume median diameter (VMD) for the drift analysis was 134 micrometers (µm). A larger VMD may be used for the mist blower SLF applications but AgDrift does not allow changing the input for VMD under the two mist blower treatment options.

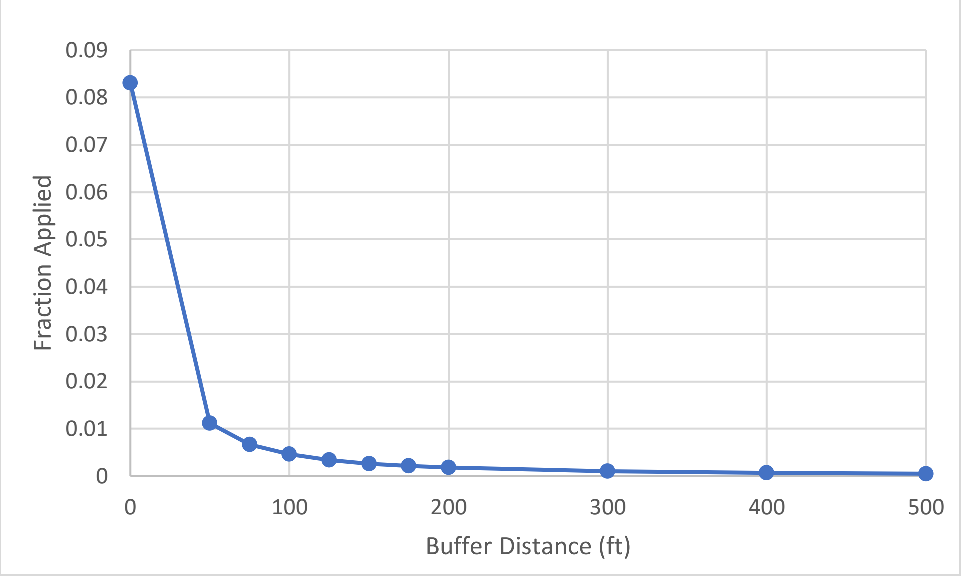

Figure 4. Drift reduction curve for mist blower applications using various buffer distances.

Like other application methods the amount of off-site drift decreases significantly from the edge of a field over a relatively short distance away from the spray block (figure 4). Drift reductions under this scenario declined 96.8% at 150 ft. and 99.4% at 500 ft. when compared to the edge of field value. AgDrift does not allow the user to estimate a drift value where there is zero drift. Large reductions in drift reduce the exposure and risk to nontarget organisms; however, even with significant reductions at various buffer distances the remaining residues may still pose a risk, especially for highly toxic insecticides such as bifenthrin and β-cyfluthrin. Estimates of aquatic residues are needed to determine if the reductions in drift provide adequate protection to nontarget aquatic organisms.

Aquatic residues were estimated for bifenthrin and β-cyfluthrin in various sized waterbodies using AgDrift for the standard program buffer (150 ft.) and the buffer proposed to protect federally listed aquatic species, including designated critical habitat (500 ft.) (table 2). Waterbody volumes are based on those recommended for screening level impacts to listed species (USEPA, 2020a). The values represent an instantaneous average concentration in static waterbodies of various volumes and do not account for environmental fate or any contribution from runoff. As previously discussed, the contribution from runoff for either insecticide is anticipated to be negligible. Environmental fate and field data for both insecticides suggest that residues that drift to water would rapidly dissipate to the sediment but could accumulate in sediment over time if there are multiple applications and the insecticide is persistent, such as the case for bifenthrin (table 1).

Table 2. Estimated initial average aquatic residues for bifenthrin and β-cyfluthrin using mist blower treatments.

Chemical/Buffer Distance	**Initial average aquatic residues (ng/L) in various static waterbody dimensions (depth x width (m))**		
	0.1 x 2	**1 x 8**	**2 x 100**
Bifenthrin (150 ft)	300.84	26.77	4.80
Bifenthrin (500 ft)	24.02	2.30	0.69
β-cyfluthrin (150 ft)	250.24	22.27	3.99
β-cyfluthrin (500 ft)	19.98	1.91	0.57

The range of static waterbodies that were used in this exposure analysis are assumed to represent a worst-case scenario for residues when compared to larger bodies of water and flowing bodies of water where dilution would be greater.

The estimated exposure values are for screening purposes and are not considered representative of actual residues that may occur in a field application. While average application heights using mist blowers are expected to be greater, AgDrift does not account for wind direction restrictions that are part of the SLF program. Applications made when the wind direction is blowing away from aquatic habitats would significantly reduce offsite transport of either insecticide from runoff or drift to waterbodies.

Effects Analysis

This section of the risk assessment summarizes available acute and chronic aquatic toxicity data for bifenthrin and β-cyfluthrin. This information will be used to compare effect levels with estimated aquatic residues in the risk characterization section of the risk assessment. Bifenthrin and β-cyfluthrin are considered highly toxic to aquatic invertebrates and vertebrates in acute and chronic exposures. Aquatic invertebrates are more sensitive to both insecticides compared to aquatic vertebrates based on acute and chronic toxicity testing.

Bifenthrin effects to aquatic nontarget organisms

Acute median lethality concentrations (LC_{50}) for freshwater and marine fish range from 0.15 micrograms active ingredient per liter (µg a.i. /L) for the rainbow trout, *Onchorynchus mykiss*, to 19.8 µg a.i. /L for the sheepshead minnow, *Cyprinodon variegatus* (USFS, 2015). Bifenthrin chronic toxicity data is limited for freshwater fish. USEPA (2016) reports a chronic No Observable Effect Concentration (NOEC) of 0.004 µg a.i. /L but the value is based on the most sensitive chronic fish toxicity value for a pyrethroid which is tefluthrin. Xiang et al. (2019) exposed zebrafish, *Danio rerio*, for 60 days to low doses (0.02, 0.050 and 0.100 µg a.i. /L) of 1S-*cis* and 1R-*cis* bifenthrin enantiomers. The 1S- *cis* enantiomer was shown to have a higher potency compared to the 1R-*cis* enantiomer based on the measurement of several reproductive endpoints. A NOEC was not established for the study due to effects in some endpoints at the lowest test concentration. In another study Forsgren et al. (2013) documented impacts to steelhead steroid levels and gonadal development at concentrations of 0.1 and 1.5 µg a.i./L in 14-day sub chronic exposures to bifenthrin. These were the only test concentrations tested in the study, and therefore, a NOEC was not established. USEPA (2016) reported a chronic NOEC and Lowest Observable Effect Concentration (LOEC) of 0.1 and 0.14 µg a.i. /L, respectively, in a 115-day sheepshead minnow life cycle study testing bifenthrin. Effects were based on a significant reduction in fecundity and in the F_0 generation time to hatch.

Several studies assessing the acute and chronic effects of bifenthrin to aquatic invertebrates are available. Bifenthrin is considered highly toxic or very highly toxic to aquatic invertebrates dependent upon the test species. The most sensitive species in acute bifenthrin exposures is the freshwater amphipod, *Hyallela azteca*, with reported 96-hour median effective concentration (EC_{50}) and LC_{50} values of 0.49 nanograms active ingredient per liter (ng a.i./L) and 1.5 ng a.i. /L, respectively (USEPA, 2016; Graves et al., 2014). Tolerant aquatic invertebrate species include the freshwater cladoceran, *Daphnia magna*, with a reported 48-hour EC_{50} value of 1,100 ng a.i./L. Some species and strains of mosquito, *Culex tritaeniorhynchus*, have also been shown to be tolerant to bifenthrin with 24-hour EC_{50} values at or above 1 mg a.i./L (Yoo et al., 2013).

Bifenthrin acute toxicity data for aquatic vertebrates and invertebrates are characterized below in a species sensitivity distribution (SSD) curve (figure 5) (tables 5a and 5b). The SSD was prepared using the SSD Toolbox software developed by USEPA, Office of Research and Development (USEPA, 2020). Data points in the SSD represent log transformed 24-hour to 96-hour EC_{50} and LC_{50} values for various freshwater and marine test species. The data also includes acute studies conducted with bifenthrin formulations and the technical active ingredient alone. The SSD was used to estimate a hazardous concentration (HC_5) that represents protection of 95% of the species represented in the SSD. This value can be compared to estimated bifenthrin residues that could occur in waterbodies due to mist blower applications. The HC_5 for the acute toxicity SSD for bifenthrin is 9.02 ng/L.

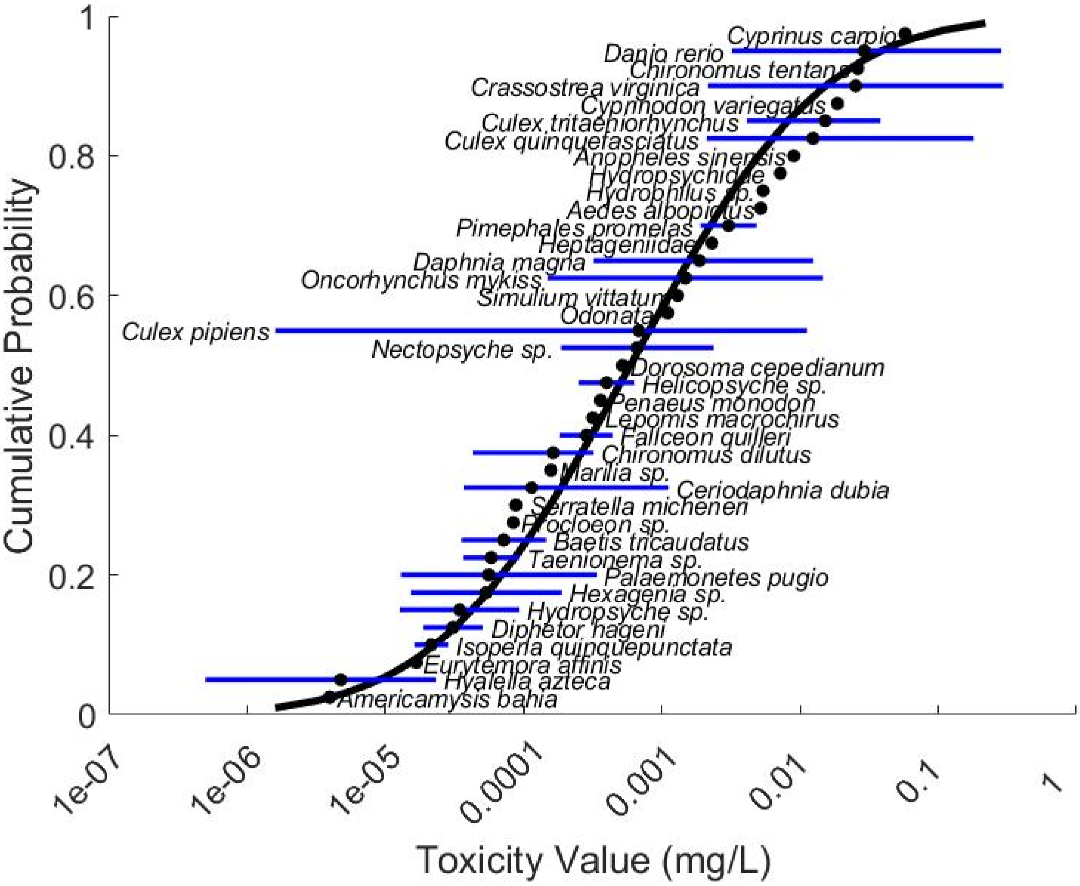

Figure 5. Acute SSD curve using EC_{50}/LC_{50} bifenthrin aquatic toxicity values. Note: Black data points with blue lines represent geometric mean values with the associated range when multiple data points are available for the same species.

Chronic toxicity data for bifenthrin is available for several aquatic invertebrate test species. Exposure periods for these studies typically range from 21 to 28 days, except for the amphipod study which was 10 days. Like the acute toxicity data, the amphipod is the most sensitive test species in chronic exposures with a NOEC and LOEC below 0.5 ng/L (table 3).

Table 3. Sublethal toxicity values for aquatic invertebrates in chronic exposures to bifenthrin.

Test Species	NOEC (ng/L)	LOEC (ng/L)	Reference
Hyallela azteca	0.17	0.34	Amweg et al., 2005
Americamysis bahia	1.2	1.3	FAO, 2012
Daphnia magna	1.3	2.9	USEPA, 2016
D. magna	1	4	Ye et al., 2004
Leptocheirus plumulosus	5	13	USEPA, 2021
D. magna	10	20	Wang et al., 2009
D. magna	10	20	Zhao et al., 2009
D. magna	20	40	Brausch et al., 2010

The subchronic and chronic EC_{50} and LC_{50} values are represented in the SSD for aquatic vertebrates and invertebrates (figure 6) (tables 5a and 5b). The chronic HC_5 for chronic effects to aquatic vertebrates and invertebrates is 2.9 ng/L.

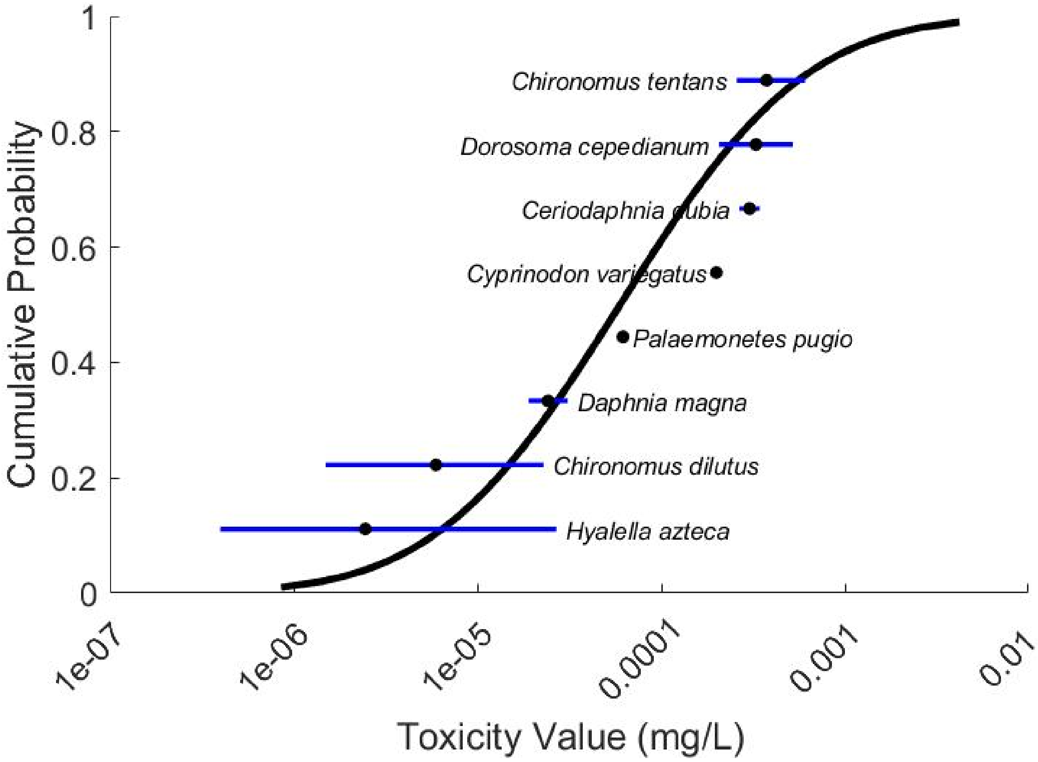

Figure 6. Subchronic and chronic SSD curve using EC_{50}/LC_{50} bifenthrin aquatic toxicity values. Note: Black data points with blue lines represent geometric mean values with the associated range when multiple data points are available for the same species.

Aquatic invertebrates that occupy the sediment have also been evaluated in toxicity studies due to the environmental fate of bifenthrin and preference to partition to sediment. In a 10-day exposure using the freshwater amphipod, *H. azteca*, the NOEC and LOEC values in pore water were 0.05 ng/L and 0.09 ng/L, respectively. The NOEC and LOEC values in sediment were 0.25 µg a.i./kilogram (kg)dry weight (dw) and 0.45 µg a.i./kg-dw, respectively (USEPA, 2016). In a 28-day study using the marine amphipod, *Leptocheirus plumulosus*, the pore water NOEC and LOEC values were <0.6 ng a.i./L and 0.6 ng a.i./L, respectively. The NOEC and LOEC values in sediment were <5.4 µg a.i./kg-dw and 5.4 µg a.i./kg-dw, respectively (USEPA, 2016).

Toxicity to algae is low with effects noted at concentrations that exceed the solubility limit for bifenthrin. USEPA (2016) reports a 7-day EC_{50} greater than 330 µg a.i./L for the vascular plant duckweed, *Lemna minor*. In another 7-day exposure the EC_{50} for the marine diatom, *Skeletonema costatum*, was greater than 290 µg a.i./L. The NOECs for both studies were the highest test concentration. EFSA (2011) reported an EC_{50} of greater than 8 mg a.i./L for the green algae, *Desmodesmus subspicatus*, testing a Talstar formulation. The same assessment also reported an EC_{50} of 0.822 mg a.i./L for the green algae species, *Raphidocelis subcapitata*, based on a reduction in dry weight.

The persistence of bifenthrin, its lipophilic properties (high Kow), and low water solubility suggest it may bioconcentrate in aquatic biota. Bioconcentration factors (BCFs) have been measured in several aquatic organisms. USFS (2015) summarized BCFs (L/kg) from USEPA for bluegill sunfish (6,090 whole fish), *D. magna* (2,500 to 4,600) and *H. azteca* (1,180) in water exposures.

β-cyfluthrin effects to aquatic nontarget organisms

The reported values below include cyfluthrin and β-cyfluthrin toxicity values. Cyfluthrin is made up of four pairs of enantiomers (eight isomers), while *beta*-cyfluthrin is a mixture of pairs of enantiomers II and IV of cyfluthrin, in a ratio of 1:2. Cyfluthrin values were adjusted where USEPA provides justification however in other peer reviewed studies that are presented below the values are represented as reported in each paper.

β-cyfluthrin is highly toxic to fish and very highly toxic to most aquatic invertebrates based on available acute toxicity data. Acute 96-hour LC_{50} values for fish range from 0.068 µg a.i/L in the rainbow trout to 4 µg a.i/L for the sheepshead minnow (USEPA, 2021). In the acute rainbow trout study the NOEC was reported as less than 0.039 µg a.i/L based on loss of equilibrium, erratic swimming, and lethargy. Chronic fish toxicity data for β-cyfluthrin is limited to an early-life stage (ELS) and full life cycle study using the rainbow trout and fathead minnow, respectively. In the rainbow trout ELS study the NOEC was 0.0042 µg a.i/L based on reduced growth and behavioral effects. The NOEC was based on the estimate of β-cyfluthrin equivalents because the study was conducted using cyfluthrin and the values were adjusted to account for the percent of active isomers in cyfluthrin compared to β-cyfluthrin (USEPA, 2013). There is also a fish full life cycle study using the fathead minnow with a reported NOEC of 0.014 µg a.i/L (USEPA, 2013).

The range of toxicity values for aquatic invertebrates is variable for β-cyfluthrin with the most sensitive species, the freshwater amphipod, *H azteca*, having a 96-hour LC_{50} value of 0.34 ng a.i./L, and the least tolerant species, the eastern oyster, *Crassostrea virginica*, having a reported EC_{50} value of 2.5–5.0 µg a.i/L (USEPA, 2021).

β-cyfluthrin acute toxicity data for aquatic vertebrates and invertebrates are characterized below in a SSD curve (figure 7) (table 6). The SSD was used to estimate a HC_5 that represents protection of 95% of the species represented in the SSD. This value can be compared to estimated β-cyfluthrin residues that could occur in waterbodies due to mist blower applications. The HC_5 for the acute toxicity SSD for β-cyfluthrin is 2.9 ng/L.

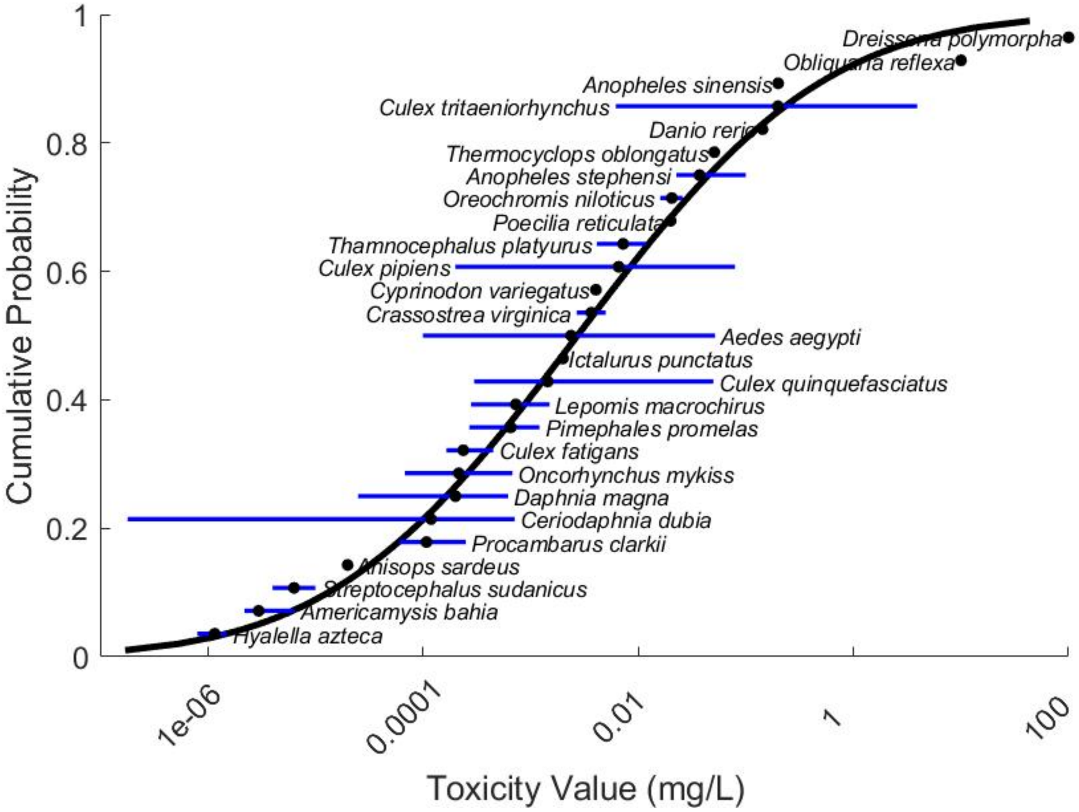

Figure 7. Acute SSD curve using EC_{50}/LC_{50} β-cyfluthrin aquatic toxicity values. Note: Black data points with blue lines represent geometric mean values with the associated range when multiple data points are available for the same species.

Subchronic and chronic LC_{50} values range from 1.7 ng a.i./L for *H azteca*, to 123 ng a.i./L for *C. tentans* in 10-day exposures (Xu et al., 2007; Deanovic et al., 2013). In a chronic 7-day life cycle study using the freshwater cladoceran, *Ceriodaphnia dubia*, the reported LC_{50} was 712 ng a.i./L.

Due to the lack of data points a subchronic and chronic SSD using LC_{50} values was not calculated for β-cyfluthrin.

Amphipods and the mysid shrimp are considered the most sensitive species to chronic exposures of β-cyfluthrin with the cladoceran, *C. dubia*, the more tolerant species (table 4). Study durations range from 7-days for the life cycle study using *C. dubia*, to 28 days in the life cycle study using the mysid shrimp*, Americamysis bahia*.

Table 4. Sublethal toxicity values for aquatic invertebrates in chronic exposures to β-cyfluthrin.

Test Species	NOEC (ng/L)	LOEC (ng/L)	Reference
Americamysis bahia	0.41	0.83	USEPA, 2016
Hyalella azteca	2.2	3.7	Deanovic et al., 2013
Daphnia magna	7.4	15.7	USEPA, 2016
Ceriodaphnia dubia	268	515	Deanovic et al., 2013

Chronic toxicity to aquatic invertebrates has also been evaluated in water/sediment exposures. USEPA (2016) reports that in the life cycle study using the midge, *C. dilutus*, the NOEC and LOEC in sediment was 1.6 µg a.i./kg and 3.1 µg a.i./kg, respectively. The pore water NOEC and LOEC values were 0.4 ng a.i./L and 7.0 ng a.i./L, respectively. In a 42-day study using the freshwater amphipod, *H. azteca*, the NOEC and LOEC values in sediment were 8 µg a.i./kg and 20 µg a.i./kg, and in pore water the NOEC and LOEC values were 1.4 ng a.i./L and 3.4 ng a.i./L, respectively.

The toxicity of β-cyfluthrin to aquatic plants is low based on available laboratory toxicity testing. USEPA (2016) reports an EC_{50} value of >181 µg a.i./L for the green algae *R. subcapitata*, and >2 µg a.i./L for another species of green algae, *Scenedesmus subspicatus*, after exposure to cyfluthrin. Both values are greater than the highest test concentration and exceed the solubility limit for β-cyfluthrin. Saenz et al. (2012) reported that the median inhibition concentrations (IC_{50}) exceeded the solubility limit for cyfluthrin for growth and various physiological and biochemical endpoints when testing the effects of a formulated product on various green algal species (*Chlorella vulgaris, S. acutus, R. subcapitata*). Data do not appear to be available testing the effects of cyfluthrin or β-cyfluthrin on aquatic macrophytes; however, the low toxicity to various algal species, and mode of action for pyrethroid insecticides, suggests that toxicity would be low.

Like most pyrethroid insecticides, cyfluthrin and β-cyfluthrin have high Kow values suggesting that they are lipophilic and could accumulate in aquatic organisms. USEPA (2016) reports a BCF of 854 for cyfluthrin in whole fish using the rainbow trout. The depuration rate is moderately rapid with a half-life of less than 3 days. The depuration rate is the rate of the loss of cyfluthrin that occurred in rainbow trout after the exposure phase of the study ends.

Risk Characterization

This section of the risk assessment integrates the exposure analysis and potential residues from the proposed mist blower applications with the effects analysis to determine the potential for direct or indirect effects to aquatic resources. Direct effects are defined as those effects that may result from exposure to bifenthrin or β-cyfluthrin in aquatic environments. Direct effects can result from acute and chronic exposure. Indirect effects are defined as those effects that may result in reduced prey or impacts to habitat that support other aquatic invertebrates or vertebrates. Exposure values that exceed acute and chronic toxicity values suggest that there may be risk to nontarget organisms and require further discussion regarding assumptions in the risk assessment. This risk assessment provides a screening level approach that makes several conservative assumptions in the exposure and effects analysis sections These assumptions are discussed in more detail below where residues exceed toxicity values.

Bifenthrin

The implementation of the 500 ft. buffer results in residues that are below the range of acute fish toxicity values in all waterbody volumes suggesting low direct risk in acute exposures (figure 8). The 150 ft. buffer results in residues in the smallest waterbody modeled that exceed acute toxicity values for sensitive fish species.

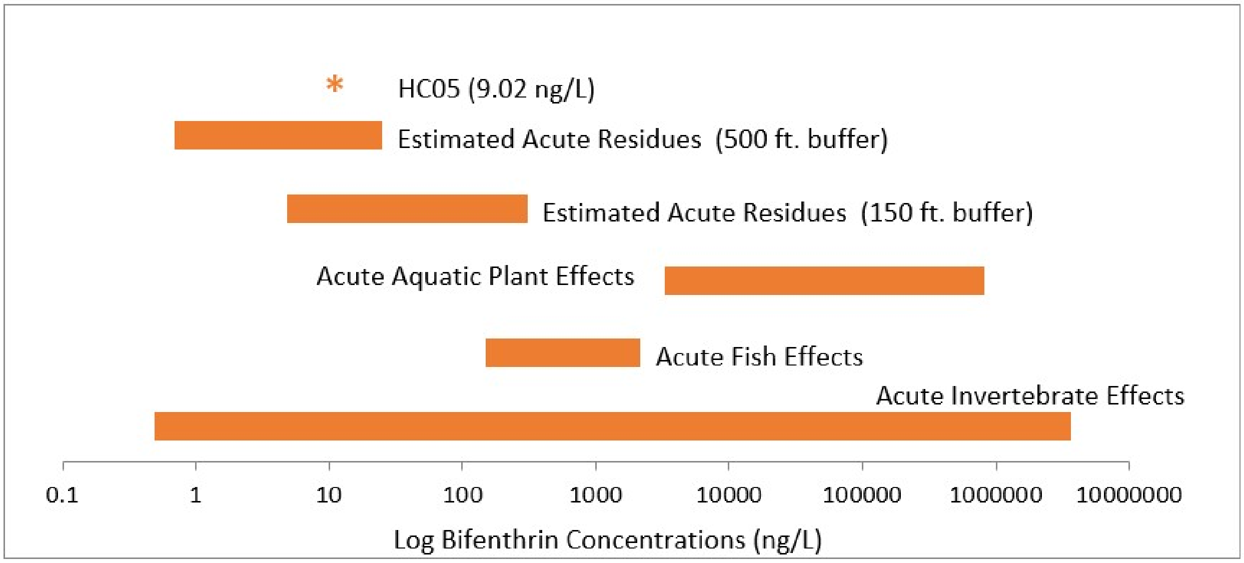

Figure 8. Acute aquatic risk characterization for bifenthrin.

Bifenthrin residues exceed acute invertebrate toxicity values for both buffer sizes in the various waterbodies evaluated in this risk assessment. At 500 ft. residues exceed the lower range of sensitivities for aquatic invertebrates. The residue estimates in this risk characterization do not account for the dissipation of bifenthrin from the water column. Dissipation occurs rapidly for bifenthrin with greater than 90% removal from the water column in less than 24 hours. Many of the acute toxicity values for invertebrates are based on 48-hour or 96-hour exposure durations in either flow through or static renewal studies. These values likely overestimate effects since exposure duration in the environment would be short and at lower concentrations based on laboratory and field-collected environmental fate data for bifenthrin. Sorption is a primary factor affecting bioavailability of bifenthrin, and other pyrethroids. Physicochemical properties of bifenthrin and other pyrethroids, the quality and quantity of (dissolved) organic matter, particle sizes of sediment, the content of suspended solids, aging, and salinity all affect sorption (Lu et al., 2019). In the presence of organic matter and sediments bifenthrin bioavailability to water column aquatic invertebrates and vertebrates would be decreased. Bifenthrin exhibits desorption coefficients comparable to adsorption coefficients that suggest movement to the dissolved phase would be negligible.

Implementation of the 500 ft. buffer results in residues that are below the acute and chronic HC_5 in the static waterbodies modeled in the exposure analysis except for the smallest waterbody (0.1 m x 2 m). Implementation of a 150 ft. buffer results in residues that are below the acute and chronic HC_5 for the largest waterbody but exceeds values in the two larger static waterbody volumes. The HC_5 can be used to evaluate direct impacts to various aquatic taxa as well as indirect effects for those species that rely on aquatic invertebrates and vertebrates as prey items. Indirect effects are anticipated to be low from the use of bifenthrin with implementation of the 500 ft. buffer except for the smallest waterbodies. Direct and indirect risk is greater when implementing the 150 ft. buffer with impacts to the two smallest water body volumes.

No risks are anticipated to aquatic plants from the proposed mist blower applications of bifenthrin using either buffer. Indirect effects to habitat for fish and aquatic invertebrates would not be anticipated in any waterbody size based on the lack of residues that would impact aquatic plants. Risk is much lower because the aquatic plant toxicity values are higher than the highest test concentration and exceed solubility for bifenthrin.

The lowest chronic fish endpoint (NOEC = 4 ng a.i./L) is below the acute residues that were estimated using the 500 ft. buffer except for the 0.1 m x 2 m isolated waterbody. Residues exceed the chronic fish NOEC in each of the first two waterbody sizes using the 150 ft. buffer but do not exceed the residues estimated in the largest waterbody evaluated in this risk assessment (2 m x 100 m). These estimates likely overestimate risk because chronic water column exposures to fish are not expected, based on the rapid dissipation of bifenthrin to the sediment. Exposure to bifenthrin in the water column would occur primarily via suspended solids and organic matter.

Chronic risk is greatest for sediment-dwelling aquatic invertebrates. In the case of bifenthrin, residues are expected to persist due to the long half-life under aerobic and anaerobic aquatic conditions (table 1). The minimum application interval is 28 days and little degradation would be expected between treatments. USEPA (2016a) used the pesticide environmental fate model, Pesticide in Water Calculator (PWC), to estimate water column, pore water, and sediment concentrations for bifenthrin using an orchard airblast application scenario. The PWC estimates pesticide residues in surface water and ground water from drift and runoff using weather data, site specific soils data, and pesticide use and environmental fate information (USEPA, 2016b). Three applications (0.22 lb. a.i./ac) were made every 15 days to pecan orchards in Georgia. Modeled values were the same between water column and pore water concentrations at peak and 21-days post treatment. Based on the results of the PWC modeling the water column residues estimated using AgDrift were assumed to be the same as would occur in pore water. Comparing the range of acute aquatic residues in the three waterbodies modeled in this risk assessment at 150 ft. (4.8 to 300.84 ng/L) and 500 ft. (0.69 to 24.02 ng/L) to the lowest estimated porewater NOEC (0.05 ng/L) suggests the potential for adverse impacts to sediment dwelling invertebrates. These risks are reduced based on the other program measures that are intended to reduce exposure to aquatic nontarget organisms.

β-cyfluthrin

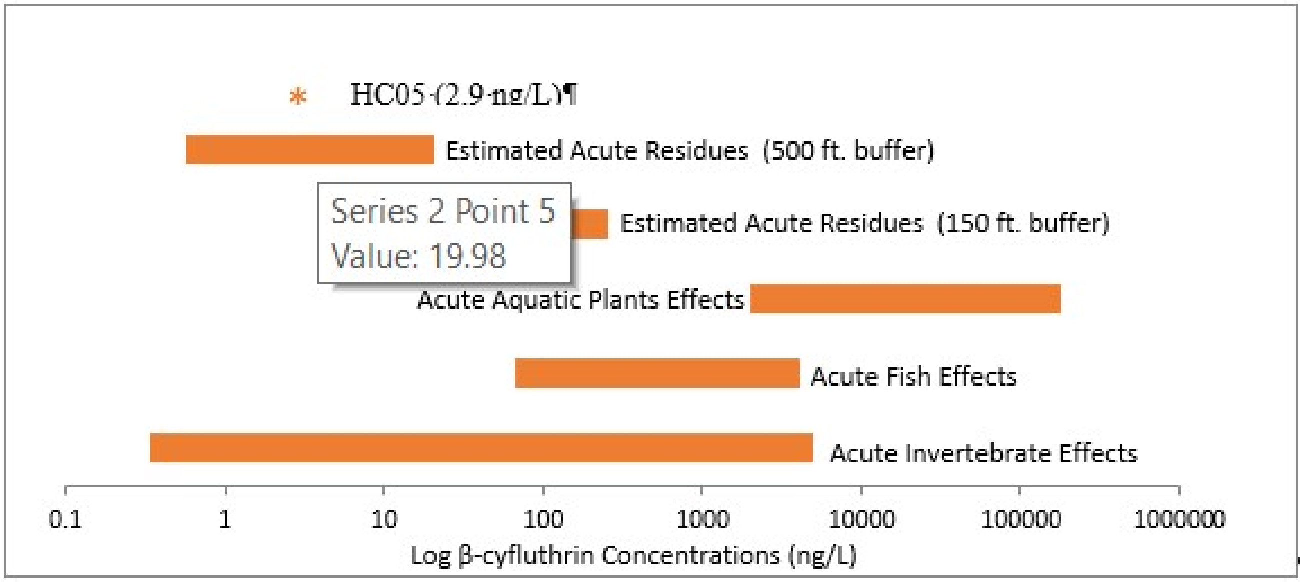

Figure 9. Acute aquatic risk characterization for β-cyfluthrin

The risk profile for aquatic invertebrates is also similar between bifenthrin and β-cyfluthrin. Some sensitive aquatic invertebrates are at risk from acute and chronic water column exposures. More species are at risk with the implementation of the 150 ft. buffer when compared to the 500 ft. buffer. Like bifenthrin these estimates likely overestimate risk because exposure duration in the environment would be short and at lower concentrations due to the low solubility for β-cyfluthrin, its preference to bind to organic matter and sediments, degradation in the presence of light, and shorter hydrolysis half-life in alkaline waters.

Indirect risks to aquatic species that depend on aquatic vertebrates and invertebrates as prey items are anticipated to be low in all but the smallest waterbody evaluated based on the HC_{05} value and implementation of the 500 ft. buffer. Exceedance of the HC_{05} occurred in all waterbody volumes evaluated with implementation of the 150 ft. buffer.

β-cyfluthrin risks to aquatic plants from the proposed mist blower applications are anticipated to be negligible. Indirect effects to habitat for fish and aquatic invertebrates would not be anticipated in any waterbody size based on the lack of residues that would impact aquatic plants. The actual risk is much lower because the aquatic plant toxicity values are expressed as higher than the highest test concentration and exceed water solubility.

The lowest chronic fish endpoint (NOEC = 4.2 ng a.i./L from the rainbow trout ELS study) is below the acute β-cyfluthrin residues that were estimated using the 500 ft. buffer except for the 0.1 m x 2 m isolated waterbody. Residues exceed the chronic fish NOEC in each of the first two waterbody sizes using the 150 ft. buffer and close to the residues estimated in the larger waterbody volume (3.99 ng/L) These estimates likely overestimate risk because chronic water column exposures to fish are not expected based on the rapid dissipation of β-cyfluthrin to sediment and shorter half-life when compared to bifenthrin. Exposure to β-cyfluthrin in the water column would occur primarily via suspended solids and organic matter.

Chronic risk to aquatic invertebrates from β-cyfluthrin exposure will be greatest for those species that occupy the sediment. The minimum application interval for applications is seven days; however, β-cyfluthrin is expected to degrade between applications based on its sensitivity to light and microbial degradation rates under aerobic and anaerobic conditions (table 1). Significant bioaccumulation of β-cyfluthrin is not anticipated, reducing chronic risk to sediment-dwelling invertebrates. Chronic risks to benthic invertebrates are reduced, based on the other program measures that are intended to reduce exposure to aquatic nontarget organisms.

Summary

This risk assessment evaluated the acute and chronic risks to aquatic nontarget species from the proposed use of bifenthrin and β-cyfluthrin using mist blower applications. The assessment showed acute direct risk to some sensitive fish species using the 150 ft. buffer but not when using the 500 ft. buffer. The assessment showed greater risk to aquatic invertebrates using the 150 ft. buffer compared to the 500 ft. buffer while neither buffer demonstrated risk to aquatic plants. The actual risk estimated in this assessment is anticipated to be much less based on program measures not captured in the exposure analysis. Wind direction is a significant factor in determining off-site drift (Rathnayake et al., 2021). AgDrift does not allow for changing wind direction when simulating drift using mist blower applications. The SLF program is proposing to avoid mist blower applications when the wind direction is blowing toward a waterbody. This measure, in addition to the buffer zones that were evaluated in this risk assessment, will significantly reduce drift and runoff that would result in acute and chronic exposure to nontarget aquatic organisms. Other factors such as interception of drift by plants will further reduce the potential for offsite drift. Pesticide interception by plants between the spray block and waterbody will be greatest for those waterbodies perpendicular to the treatment area along railway rights of way. The intent of the mist blower treatments is to spray vegetation parallel to the railroad tracks where insecticide interception by vegetation would be greatest. Within waterbodies the interception of bifenthrin and β-cyfluthrin drift is anticipated to occur more readily in shallow static waterbodies where emergent plants as well as riparian areas would be more prevalent.

USDA-APHIS will conduct environmental monitoring with the proposed SLF program, including spray drift card samples and water and/or sediment samples, to assess whether program measures are effective in reducing off-site bifenthrin and β-cyfluthrin deposition. USDA-APHIS will propose additional mitigation measures if bifenthrin and β-cyfluthrin residues occur adjacent to, or in waterbodies, that could result in potential effects to aquatic nontarget organisms.

The proposed application of bifenthrin and β-cyfluthrin in mist blowers for treating SLF along railroad rights of way and intermodal areas is anticipated to have low acute and chronic risk to nontarget aquatic organisms based on the implementation of program measures that are intended to reduce drift and runoff to waterbodies.

Tables 5a and 5b. Acute and chronic aquatic EC_{50}/LC_{50} values that were used to develop SSDs for bifenthrin.

Table 5a. Acute EC_{50}/LC_{50} values

Species	**Acute EC_{50}/LC_{50} (mg/L)**	**Reference**
Cyprinus carpio	0.0657	Velisek et al., 2009
Danio rerio	0.0292	Jin et al., 2009
Chironomus tentans	0.0261	Anderson et al., 2006
Crassostrea virginica	0.0252	USEPA, 1992
Cyprinodon variegatus	0.0186	Harper et al., 2008; USEPA, 1992

Species	**Acute EC_{50}/LC_{50} (mg/L)**	**Reference**
Culex quinquefasciatus	0.0124	Weerasinghe et al., 2015
Anopheles sinensis	0.0090	Chang et al., 2009
Hydropsychidae	0.0072	Siegfried, 1993
Hydrophilus sp.	0.0054	Siegfried, 1993
Aedes albopictus	0.0052	Ali et al., 1995
Pimephales promelas	0.0030	Beggel et al., 2010
Heptageniidae	0.0023	Siegfried, 1993
Culex pipiens	0.0020	Shin et al., 2012; Perumalsamy et al., 2010; Hardstone et al., 2007; Lee et al., 1997
Daphnia magna	0.0019	Braush et al., 2010; USEPA, 1992, Mokry and Hoagland, 1990
Oncorhynchus mykiss	0.0015	Velisek et al., 2009; USEPA, 1992
Simulium vittatum	0.0013	Siegfried, 1993
Odonata	0.0011	Siegfried, 1993
Nectopsyche sp.	6.6296e-04	Weston et al., 2015
Dorosoma cepedianum	5.2100e-04	Drenner et al., 1993
Helicopsyche sp.	3.9829e-04	Weston et al., 2015
Penaeus monodon	3.6000e-04	Hook et al., 2018
Lepomis macrochirus	3.1585e-04	USEPA, 1992
Fallceon quilleri	2.8473e-04	Weston et al., 2015
Chironomus dilutus	1.6382e-04	Weston et al., 2015

Species	**Acute EC_{50}/LC_{50} (mg/L)**	**Reference**
Marilia sp.	1.5800e-04	Weston et al., 2015
Ceriodaphnia dubia	1.1433e-04	Yang et al., 2006; Mokry and Hoagland, 1990
Serratella micheneri	8.7941e-05	Weston et al., 2015
Procloeon sp.	8.4300e-05	Anderson et al., 2006
Baetis tricaudatus	7.1993e-05	Weston et al., 2015
Taenionema sp.	5.8200e-05	Weston et al., 2015
Palaemonetes pugio	5.5804e-05	Pennington et al., 2014 ;Williamson et al., 2009; Harper et al., 2008
Hexagenia sp.	5.3632e-05	Weston et al., 2015
Hydropsyche sp.	3.4484e-05	Weston et al., 2015
Diphetor hageni	3.0852e-05	Weston et al., 2015
Isoperla quinquepunctata	2.1553e-05	Weston et al., 2015
Eurytemora affinis	1.6700e-05	Weston et al., 2015
Hyalella azteca	4.7673e-06	Ding et al., 2012; Anderson et al., 2006
Americamysis bahia	3.9700e-06	USEPA, 1992

Geometric mean acute toxicity values were calculated when multiple values for the same species were reported.

Table 5b. Chronic EC_{50}/LC_{50} values

Species	**Chronic EC_{50}/LC_{50} (mg/L)**	**Reference**
Chironomus tentans	3.7512e-04	Anderson et al., 2015
Dorosoma cepedianum	3.2840e-04	Denner et al., 1991
Ceriodaphnia dubia	3.0294e-04	Deanovic et al., 2013

Species	**Chronic EC_{50}/LC_{50} (mg/L)**	**Reference**
Cyprinodon variegatus	2.0000e-04	Pennington et al., 2014
Palaemonetes pugio	6.2000e-05	Pennington et al., 2014
Daphnia magna	2.4269e-05	Wang et al., 2009
Chironomus dilutus	5.9492e-06	Ding et al., 2012
Hyalella azteca	2.4571e-06	Anderson et al., 2015

Geometric mean chronic toxicity values were calculated when multiple values for the same species were reported.

Table 6. Acute aquatic EC_{50}/LC_{50} values that were used to develop the SSD for β-cyfluthrin.

Species	**Acute EC_{50}/LC_{50} (mg/L)**	**Reference**
Dreissena polymorpha	100.0000	Waller et al., 1993
Obliquaria reflexa	10.0000	Waller et al., 1993
Anopheles sinensis	0.2000	Chang et al., 2009
Culex tritaeniorhynchus	0.1991	Yoo et al., 2013; Shin et al., 2011
Danio rerio	0.1432	Padilla et al., 2012
Thermocyclops oblongatus	0.0510	Chippaux et al., 1996
Anopheles stephensi	0.0372	Vasuki and Rajavel 1992, Rajavel et al., 1987
Oreochromis niloticus	0.0206	Tejada et al., 1994
Poecilia reticulata	0.0200	Tejada et al., 1994
Thamnocephalus platyurus	0.0073	Brausch et al., 2009a,
Culex pipiens	0.0066	Shin et al., 2012; Perumalsamy et al., 2010
Cyprinodon variegatus	0.0041	USEPA, 1992
Crassostrea virginica	0.0037	USEPA, 1992

Species	**Acute EC_{50}/LC_{50} (mg/L)**	**Reference**
Aedes aegypti	0.0024	Canyon and Hii, 2009; Rodriguez et al., 2007; Vasuki and Rajavel, 1992
Ictalurus punctatus	0.0020	Waller et al., 1993
Culex quinquefasciatus	0.0014	Weerasinghe et al., 2015; Rajavel et al., 1987
Lepomis macrochirus	7.2936e-04	USEPA, 1992
Pimephales promelas	6.5592e-04	De Perre et al., 2015; Heath et al., 1994
Oncorhynchus mykiss	2.1538e-04	Waller et al., 1993; USEPA, 1992
Daphnia magna	2.0059e-04	De Perre et al., 2015; USEPA, 1992; Brausch et al., 2009b
Ceriodaphnia dubia	1.1896e-04	Yang et al., 2007
Procambarus clarkii	1.0784e-04	Quaglio et al., 2001; Morolli et al., 2006
Anisops sardeus	1.9975e-05	Lahr et al., 2001
Streptocephalus sudanicus	6.3246e-06	Lahr et al., 2001
Americamysis bahia	2.9718e-06	USEPA, 1992
Hyalella azteca	1.1598e-06	De Perre et al., 2015 Lanteigne et al., 2015

Geometric mean acute toxicity values were calculated when multiple values for the same species were reported.

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Appendix B. Response to comment to draft spotted lanternfly environmental assessment

APHIS received 1 comment on the Draft Spotted Lanternfly Environmental Assessment during the 35-day public comment period. A commenter wanted the use of glyphosate banned from the United States and the world, indicating it was a deadly, toxic chemical contaminating our food, water, and planet and questioned whether congress was protecting the company with a law against banning it. The SLF Program uses foliar applications of glyphosate to treat sprouting *A. altissima*. All applications and use restrictions are made according to EPA-approved label requirements either by hand painting undiluted material on the trunk of the *A. altissima* seedling or sapling or directly spraying sprouting foliage using a backpack sprayer. No applications will be made to food crops and the proposed use pattern will not result in contamination of water used for drinking water by the public. Impacts to food, water and the environment are not anticipated because the use of the glyphosate in the SLF program is minimal and use methods are directed to individual *A. altissima* plants