DRAFT # 2

Open for Comment

Spotted Lanternfly
Washington State Action Plan

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Purpose Statement

Written by Jessica La Belle, WISC
To be added before the final draft.

Abbreviations and Acronyms

Abbreviation	Definition
CAPS	Cooperative Agriculture Pest Survey Program
CEMP	Comprehensive Emergency Management Plan
ESF	Emergency Support Function
FSH	Forest Service Handbook
ICS	Incident Command System
IPM	Integrated Pest Management
MAC-G	Multiagency Coordination Group
PPA	Plant Protection Act
RCW	Revised Code of Washington
SEOC	State Emergency Operations Center
SLF	Spotted Lanternfly
SCC	Washington State Conservation Commission
SDS	Safety Data Sheet
TOH	Tree-of-Heaven
UCG	Unified Coordination Group
USFS	United States Department of Agriculture Forest Service
USDA APHIS PPQ	U.S. Department of Agriculture Animal and Plant Health Inspection Service Plant Protection and Quarantine
WACD	Washington Association of Conservation Districts

Introduction and Background

Biology and Life Cycle of Spotted Lanternfly

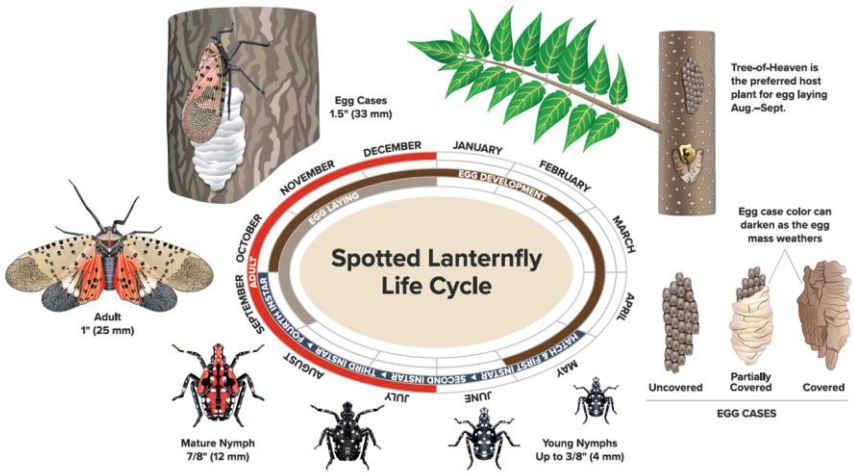
Written by Jessica La Belle, WISC & Fiona Smeaton, Samara Group

Spotted lanternfly, *Lycorma delicatula* (White 1845), is an insect native to the subtropical regions of southeast Asia (China, India, Bangladesh, and Vietnam). This species has been introduced to and is considered highly invasive in South Korea, Japan, and the United States. Spotted lanternfly (SLF) are planthoppers (family Fulgoridae) with piercing/sucking mouthparts that feed on the nutrient rich, sugary sap in the phloem of plants. This is highly detrimental as plants rely on phloem to transport nutrients obtained in the leaves from photosynthesis to other parts of the plant. Both nymph and adult populations will feed on a variety of plants, with over 170 known species of host plants, and that number continues to climb as SLF spreads into new areas and is exposed to different plant species (Wakie, et al 2020). The nymphs will often feed

on softer plant material including new growth, leaves, and herbaceous stems, while the adults feed on the phloem, depriving the plant of nutrients and leaving it susceptible to other stressors. A unique aspect of SLF feeding behavior, and part of why it is a pest of concern, is that the adult SLF excrete honeydew almost continually as they feed. These sugary excretions promote the growth of sooty mold (*Ascomycota* spp), weakening the host plant and often resulting in its demise (PennState Extension 2021). SLF have proven to be generalists and will easily adapt to varying conditions (Francese et al. 2020). SLF feeds on plants of agricultural, environmental, economic, and ethnobotanical significance to great devastation in states where infestations have been detected. It is for these reasons that the detection of SLF in Washington state would be considered a plant health emergency.

SLF has expanded to over 25% of the United States since its initial discovery in Pennsylvania in 2014. In addition to spreading through flight or walking, SLF will often hitchhike onto moving objects and travel greater distances than anticipated. All life stages may be found to travel across the continent through various pathways, and deceased SLF have already been found in Pacific coastal states. Their egg masses in particular can be found on organic or inorganic substances and have high survivability to traveling far distances through many different temperatures.

Figure # Illustration credit: Washington State University Extension & Washington State Department of Agriculture



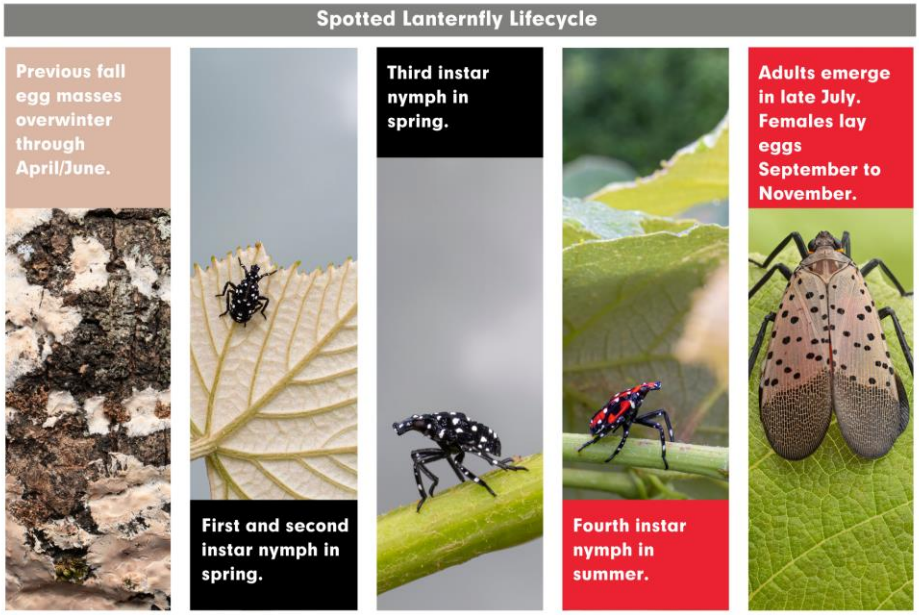
In the eastern United States where SLF has established populations, adult females will typically start to lay eggs from September to November, though they may lay eggs as late as December (Essler et al. 2021). They will search out areas to lay their egg masses on tree bark, with their

preferred host plant being Tree-of-Heaven *Ailanthus altissima* (Mill.) Swingle. However they will often deposit eggs on the smooth or rusty surfaces of man-made objects, such as lawnmowers, bikes, grills, vehicles, and more. Their egg masses resemble a smear of mud as the females will cover individual egg masses with wax that dries and cracks to look like mud. Each covered egg mass is about an inch long and will contain 30 to 50 eggs, though there can be multiple egg masses per surface (USDA APHIS SLF) (PennState Extension 2021).

The SLF first instar nymph will emerge from their egg cases in late spring and will climb up the host trees towards the canopy. If the nymphs are dislodged by wind or other obstacles, they will seek out a new tree and continue to climb up (Francese et al. 2020). The first instar nymphs are about one fifth of an inch (5 mm) long and all black with white spots. The second and third instar nymphs will keep this coloration and grow to about one quarter to one third of an inch long. Nymphs will molt into the fourth instar from July through September, and emerge with a brilliant red coloration on the upper body with white spots, and black on the lower body. The final molt will occur in late summer to early fall when the adult SLF emerges.

Commented [1]: Newly hatched nymphs are white and lack the black coloration associated with nymphs. This is for a few hours until the nymphs darken.

Figure # Year-long life cycle of the SLF as seen in the Eastern U.S.



Adult SLF are approximately 25mm (just under one inch) in length. The head and legs are dark brown to black in color, and the antennae are very short and rounded with orange tips. The proboscis, or piercing-sucking mouthpart, is held folded along the underside of the body when not in use and is 7mm in length. The forewings are light gray to light brown with black spots, while the distinctive hindwings are banded in black, white, and red at the posterior. The tips of

the wings have distinct veins (Mermer et al. 2021). When at rest with the wings folded back along the body, the forewings may appear slightly pinkish in hue as the red hindwing coloration can be seen through it. The brightly colored hindwings are the most recognizable feature of the SLF, but may only be visible when the insect is alarmed or about to take flight. The abdomen is a pale yellow with short black bands. Their leg length is approximately two thirds of an inch (Mermer et al. 2021). Males and females are identical in coloration throughout all life stages; the only visible differences are that adult females have a set of small red valvifers at the end of the abdomen, and when gravid the abdomen may become grossly swollen.

Figure # Photo is by Julie Urban, with the piercing-sucking proboscis outlined.

Figure # Adult Spotted Lanternflies are most commonly seen resting, with their wings folded

Host Plants

Written by Stacy Horton, NPCC- WA

Adult Spotted Lanternfly preferred host is the Tree-of-Heaven

The rapid spread of the SLF is facilitated by the prevalence of its preferred host, Tree-of-Heaven (TOH) *Ailanthus altissima* (Mill.) Swingle, as well as its use of many other host plants (Barringer and Ciafré 2020). An SLF host plant is any plant species where the insect is found during any stage of its lifecycle. SLF will subside, feed and lay eggs on host plants. Adult SLF prefers to feed and lay eggs on TOH (USDA). Scientists had speculated that the SLF could not develop or reproduce without access to TOH, and while this assumption was found to be incorrect, fitness of the SLF was reduced, and the number of egg masses laid was dramatically lower for other host plants (Uyi et al. 2021). Environments like highways, railroad corridors, and logging roads usually have abundant TOH and wild grapes, providing for dispersal of the SLF (Barringer and Ciafré 2020). Scientists and others are keeping an eye on the TOH as it is a likely setting for SLF to be detected in Washington state.

Figure #

Tree-of-Heaven in Washington State is an invasive species

In Washington state, the TOH is an invasive fast-growing tree that primarily grows in open areas (WSDA), and can commonly be found along forest edges, woodlands, fence rows, roadsides, railroad embankments, old fields, and urban parks (NWCB). It is considered a class C noxious weed in Washington State (King County). While TOH is more abundant in eastern Washington, it is found throughout the state (WSDA). The Washington State Noxious Control Board is actively working to map the location of the TOH to guide removal efforts (WSDA).

Additional Host Plants

SLF is an invasive pest that feeds on a large variety of plant species, including those in the agricultural, timber, ornamental industries, and backyard plants. (PennState Extension). The potential to impact a wide assortment of ecosystems throughout its potential range and its North American distribution may not be limited by the presence of TOH (Barringer and Ciafré 2020). Through field observations, ongoing research, and recent publications, SLF is reported to feed on at least 56 taxa in North America, increasing the known worldwide feeding plant taxa to 103 (Barringer and Ciafré 2020), and when including plants that SLF will lay egg masses on, this number rises to 172 (CAFE 2022). If allowed to spread in the United States, SLF could damage the country's grape, orchard, and logging industries (USDA).

Hosts reported for this insect include, but are not limited to: American beech (*Fagus grandifolia*), American linden (*Tilia americana*), American sycamore (*Platanus occidentalis*), big-toothed aspen (*Populus grandidentata*), black birch (*Betula lenta*), black cherry (*Prunus serotina*), black gum (*Nyssa sylvatica*), black walnut (*Juglans nigra*), dogwood (*Cornus* spp.), Japanese snowbell (*Styrax japonicus*), maple (*Acer* spp.), oak (*Quercus* spp.), paper birch (*Betula papyrifera*), pignut hickory (*Carya glabra*), sassafras (*Sassafras albidum*), serviceberry (*Amelanchier canadensis*), slippery elm (*Ulmus rubra*), tulip poplar (*Liriodendron tulipifera*), white ash (*Fraxinus americana*), and willow (*Salix* spp.) (CAFE 2022).

Late season adults tend to move away from TOH to grape vines, silver maple, willow, and other hosts and are reported to feed on almost anything as they move from one area to another in search of a preferred food source (Cornell CALS). As an example, populations have been found feeding in corn and soybean fields for short periods of time, and nymphs have been found feeding on basil, cucumber, rose, statice flowers, and even grass though none are a preferred food source (Cornell CALS).

Apples, cherries, grapes, and hops are just a few of the important species in Washington state that SLF are known to attack (King County). As SLF continues to encounter new feeding hosts as it spreads across North America, the full range of host plants used by this species remains unknown (Barringer and Ciafré 2020).

Damage –Feeding Injury to Plants

SLF feeds on plant sap to acquire nutrients (PennState Extension). Adult and immature SLF damage host plants by feeding on sap from stems, leaves, and the trunks of trees (CAFE 2022). Causes of serious damage include oozing sap, wilting, leaf curling, defoliation, and dieback in trees, vines, crops and many other types of plants (PDA 2023). Damage can also occur when large quantities of a plant's sugary sap is consumed to extract nitrogen and amino acids and large quantities of excess sugar-water is expelled, called honeydew (Cornell CALS). On sunny days, honeydew can be seen falling from trees, resembling a light rain (PennState Extension). As the honeydew accumulates, it is often colonized by sooty mold (fungi) (PennState Extension). This sooty mold can further damage the plant by blocking photosynthesis in the leaves of plants coated with the excrement (CT.gov 2021). With dense groupings of SLF, understory plants may die because of the sooty mold buildup on their leaves (PennState Extension). Though no life stage of the SLF feeds directly on fruit, sooty mold growth on the skins of grapes and tree fruit can make crops unmarketable (Cornell CALS). Impacts may also include a loss of yield or reduction in quality, reduction of cold hardiness, and in some cases, plant death (Cornell CALS). Consequences of direct feeding damage by nymphs and adults to the host trees vary greatly by host species, numbers of SLF feeding, and environmental conditions (PennState Extension). SLF likely prefers hosts with higher feeding quality such as hosts with greater available sap (Barringer and Ciafré 2020). Feeding is considered a plant stressor and may contribute to the long-term weakening of established plants and trees. High levels of adult SLF feeding can reduce the photosynthetic activity of some trees. It is possible that after heavy feeding, multiple years of sustained damage, or feeding in particularly dry years, SLF may cause significant damage to ornamental and shade trees (PennState

Extension). Consequences of direct feeding damage by nymphs and adults to the host trees vary greatly by host species, numbers of SLF feeding, season, and environmental conditions (PennState Extension).

Honeydew from the SLF can also attract other insect pests (Cornell CALS). Insects such as wasps, hornets, bees, and ants may be attracted to the sugary waste created by the lanternflies, or sap weeping from open wounds in the host plant. Host plants have been described as giving off a fermented odor when SLF is present (CAFE 2022).

Damage – Crops at risk

Many Washington state crops are at risk from the SLF, including major crops like grapes, hops, apples, stone fruit, and others (WSDA). Nymphs and adults damage plants by sucking sap from stems, trunks, and leaves (NWCB). SLF is a plant stressor that, in combination with other stressors like other insects, diseases, and weather, can cause significant damage to its host (PennState Extension). SLF alone may not kill the plant or tree, and death has only been noted in tree saplings, TOH, and grapevines. Some plants are at more risk than others (e.g., grapevines, maple, black walnut) (PennState Extension). Although the insect hasn't been found in Washington State yet, the SLF is a potentially devastating insect pest known to attack apples, cherries, grapes, hops and many other plants (King County).

Grapes – a crop at particular risk

While the list of SLF host plants is long, one of the greatest agricultural concerns falls on grapes (Cornell CALS). SLF has proven to be a serious pest of grapes (both cultivated and wild). They are swarm feeders and up to 400 adults per vine have been reported. Feeding by a population this high has been shown to weaken the vine, leading to loss of winter hardiness, reduced or no return bloom or crop, and even vine death (Cornell CALS). Feeding damage can deplete reserves and stored starches in affected plants which can be serious for sensitive plants, such as grapes (Cornell CALS). Grape vines that had significant feeding by SLF either produce mainly non-fruiting shoots or die the following year (CAFE 2022). High infestations in Pennsylvania resulted in the death of well-established grape vines (King County).

Different hosts for different life stages of SLF

While the SLF is primarily known to feed on TOH, it has many other host plants, including grape, hop, apple, stone fruit, maple, poplar, walnut, and willow (USDA 2019). The insect changes hosts as it goes through its developmental stages (USDA 2019).

SLF nymphs feed on a wide range of plant species, while adults prefer to feed and lay eggs on TOH (USDA 2019). Nymphs have an especially large host range that includes annual and perennial flowers, herbaceous plants and any new and tender plant growth, whereas adults seem to depend more on certain hosts, primarily woody stems of trees and vines (PennState Extension). First through third instar nymphs feed on young shoots of perennial and annual plants while the hardier fourth instar nymphs and adults feed directly on older tissue (Cornell CALS). A strong preference for TOH develops sometime during the fourth instar through early-to mid-staged adults and is the preferred host (Cornell CALS). Many more eggs are laid, and the egg laying begins sooner, if SLF can feed on TOH (Cornell CALS).

Feeding location varies by developmental stage. Nymphs are often found at the top of trees where new growth of trees and shrubs occur, whereas adults feed more on the trunks and branches in the Fall, and feed all through the trees earlier in their lifecycle (PennState Extension).

Adult SLF tend to stay in a preferred tree to gather and feed, while nymphs may remain on the same plant species for only a day or two (PennState Extension). A tree favored by the adult in previous years has a good chance of attracting the adults in future years, making these specific trees good candidates for removal or as targets for systemic insecticides (PennState Extension). Adults may choose a favored tree even when similar cultivars are found nearby (PennState Extension).

Where To Spot the Spotted Lanternfly

When SLF occurs in a new area, the adults are most likely to be found on TOH (Cornell CALS). Adults and nymphs frequently gather in large numbers on host plants. They are easiest to spot at dusk or at night as they migrate up and down the trunk of the plant. During the day, they tend to cluster near the base of the plant if there is adequate cover or in the canopy, making them more difficult to see. Egg masses can be found on smooth surfaces on the trunks of host plants and on other smooth surfaces, including brick, stone, and dead plants (USDA). The USDA

states that dusk is a great time to inspect your trees or other host plants for signs of this pest, as the insects tend to gather in large groups on the trunks and stems of plants at that time of day (CAFE). SLF may key in on particular host plants and may present seasonal patterns of use. The patterns in host use may change with varying weather conditions, by region, and from other factors as yet undetermined (PennState Extension). Regular monitoring of high-value plants throughout the season is recommended (PennState Extension).

Spotted Lanternfly Pest History and Pathways

Spotted Lanternfly Pest History in United States

Written by Josh Milnes, WSDA & Sven-Erik Spichiger, WSDA

SLF was first detected in the USA on September 22, 2014, when an employee of the Pennsylvania Game Commission reported an unusual insect infesting TOH (Spichiger 2014) in a rural portion of Berks County Pennsylvania. Preliminary surveys conducted by the Pennsylvania Department of Agriculture suggested that the point of introduction was a landscape stone company at the end of the road that imported stone from China. Trees covered with hundreds of SLF adults were encountered at the original detection site, as well as at the landscaping company. Empty egg masses were also found, indicating that the infestation was more than one year old. Because populations were highest at the landscaping company, a delimiting grid centered on the company and extending for five miles was surveyed for presence or absence of SLF in the fall of 2014. Results indicated spread and establishment with spot detections in the outermost grids.

The initial response was to regulate movement and attempt eradication using tree removal and insecticide-treated trap trees. Though effective, these tactics could not be performed on the massive scale needed to contain and eliminate the population. Treated properties showed more than significant reductions in population, but were later re-infested by untreated adjacent properties. Due to the massive reproductive potential, and widespread availability of key host species in the environment, the SLF population in Pennsylvania expanded past a containable event by the beginning of 2016.

Although all life stages can be unknowingly spread by humans, the egg masses pose the greatest risk for long distance spread. SLF lays egg masses on many surfaces like trees, nursery stock, vehicles, train cars, tractor trailers, lawn furniture and many other items that are often transported long distances. These egg masses resemble a splash of mud, and are easy to overlook. In addition, SLF will deposit eggs in protected areas like under loose bark, on Christmas trees, or inside of rusted barrels. Because a key host species, TOH, surrounds rail lines, intermodal facilities, highway rest areas, and airfields, SLF has an easy time depositing egg masses on conveyances that travel long distances.

Adults also pose a serious risk for long distance movement of SLF but make localized containment a real challenge. In areas of heavy infestation, adults will congregate in such high

numbers that it is impossible to not accidentally have an SLF land on items that are outside. Adults will accidentally end up in the beds of pick-up trucks, crates for harvesting apples, plant pots, horse trailers, and any other outdoor items. Even individuals who practiced personal biosecurity in Pennsylvania, unwittingly ended up having adults enter their work vehicles. The reality is that untrained and unaware residents who were not actively practicing biosecurity contributed to localized spread of SLF past areas that were being targeted for treatment.

By 2023, SLF had made use of multiple human assisted pathways to spread beyond the point of introduction to 13 neighboring and remote states. To see a current depiction of SLF distribution in the United States, visit the NYSIPM Interactive Spotted Lanternfly Map (link details in references)

In the time since its first detection, SLF has demonstrated an ability to spread to the West Coast states, with dead adults being found in air cargo in California and nursery equipment in Oregon. A viable egg mass was also detected on military equipment at a California border inspection station. Western states, including Washington, will continue to be at risk for introduction of SLF from multiple pathways.

Spotted Lanternfly is Linked to Tree-of-Heaven

Written by Josh Milnes, WSDA & Sven-Erik Spichiger, WSDA

Tree-of-Heaven is an invasive deciduous tree native to central China and Taiwan that was introduced in North America as an ornamental shade tree, and is also a preferred host of the SLF (Murman *et al.,* 2020). Due to its rapid growth and adaptability, TOH has been able to spread to over 30 states, connecting the East Coast to the West Coast (USDA National Invasive Species Information Center, 2023). Established TOH continually spreads by sending up root suckers that may emerge as far as 50 feet from the parent tree. This noxious weed has been considered a source for SLF dispersal across North America in regions where the insect has been detected. TOH populations create a “biological land bridge” across North America, allowing for potential spread of the SLF across the country and into the Pacific Northwest. Furthermore, TOH is known to grow in disturbed areas, including roadsides, fence rows, parking lot edges, and most importantly along railways. Since SLF can be spread by TOH established near rail lines, it is intuitive that TOH near rail lines or other ports of introduction would significantly increase the chances of establishment in the Pacific Northwest.

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Hitchhiking Adults

Written by Josh Milnes, WSDA & Sven-Erik Spichiger, WSDA

SLF are plant hoppers and are therefore highly efficient at hitchhiking, they will jump onto objects or other species and remain unnoticed as they are transported beyond their physical distribution range. Hitchhiking is considered the most effective mode of transporting SLF across vast distances and can explain the rapid expansion of SLF on the East coast. This is why it is imperative to safeguard Washington state from SLF hitchhiking based on existing pathways

from infested areas in the Eastern United States into Washington state, such as rail lines, ports, and highways.

Spotted lanternflies have been reported to travel an average of 3 to 4 miles by walking, jumping, and flying (CU New York State Integrated Pest Management 2023). Although they are poor flyers, they more than make it up with their powerful hind legs. All nymphal and adult stages of the SLF are capable of jumping at impressive distances. Due to their mobility, SLF is capable of spreading around on their own if unhindered through transportation (e.g. containers, vehicles, and rail). A concern to Washington is the negative impact SLF could have on the industry through hitchhiking as seen with niche modeling conducted by Wakie *et al.,* 2020, suggesting that SLF would be able to establish in large regions across Washington state.

Figure #

Traveling Egg Masses

Written by Josh Milnes, WSDA & Sven-Erik Spichiger, WSDA

All SLF life stages are capable of hitchhiking, but it is the egg stage that can be spread long distances by people who move infested material or items. It has been recorded that female SLF can deposit their egg masses on a variety of substrates including man-made objects such as rail cars, vehicles, and trailers, as well as outdoor equipment (patio furniture, RVs). There are cases where egg masses have been reported on mud flaps of semi-trucks transporting goods across

state lines on the East coast, or rail cars moving the insect across North America. The spread of SLF across Pennsylvania and into Ohio shows populations establishing along rail depots. This is most likely a direct result of the presence of TOH adjacent to rails at all of these sites.

Impacts of a Spotted Lanternfly Invasion

Economic Risk

Written by Todd Murray, WSU

SLF is a phloem feeding insect and can therefore cause direct injury to plants. Phloem-feeding insects remove nutritious plant liquids by piercing and sucking contents from the vascular tissue using modified and specialized mouthparts (Triplehorn et al. 2005). In addition to depleting nutrients from growing plants, injury from feeding can cause deformation of new vegetative and fruit growth. This injury can reduce yields and increase plant mortality resulting in the need to implement pest management activities for commercial growers and land managers to remain economically viable (Pedigo & Rice 2006).

SLF, like other piercing-sucking insects, can produce significant amounts of honeydew. Honeydew is an insect excretion composed of sugars. In aggregation, large amounts of honeydew can cover the plant stems and foliage. This excretion is a growing substrate for sooty molds (multiple fungal species). Sooty mold mats of mycelium can cover and block plant abilities to photosynthesize, affect plant metabolism, and can reduce overall yields (Alkolaly et al. 2022).

The host range of SLF is still being realized. Barringer & Ciafré, 2020, describe 103 plant species that may be injured by SLF in North America. Grapes, apples, cherries and small fruits are known hosts for SLF and economically important crops that could impact Washington state agriculture. Economic impacts to crops could also be variable pending on the surrounding vegetative structures and compositions. SLF can seek and feed on multiple hosts throughout an individual's development. Variable host combinations can increase survivorship, resulting in larger population loads and ultimately increasing crop injury (Urban & Leach 2023).

Regulated pests can cause significant economic disruption and financial losses for commercial agricultural producers and all product shipment. Losses are due to restrictive quarantines that halt movement of goods and products. When a regulated pest infests a new area, regulators require commercial producers and product distributors to follow quarantine compliance. The presence or discovery of SLF in a new location will cause increased regulations and increased costs to comply with quarantine restrictions and regulations. Added costs can include increased treatments, inspections, and certifications to move products out to markets in a manner to stop the unintentional spread of SLF individuals and populations.

The discovery and presence of SLF in Washington state would cause quarantine restrictions and enforcement of regulations. Additionally, the mobility of SLF adults and nymphs create a high risk through unintentional transportation of individuals. The cryptic nature of egg masses also increases the need for strict inspection criteria and practices in infested regions. In other areas of the country where SLF has been found, disruption of ornamental plants and Christmas trees has been significant. Washington state is the 4th largest producer of Christmas trees in the country with major export markets to Hawaii, California, Mexico, Asia, and key military units worldwide.

Economic Impact to Washington State Wine and Grape Industry

Written by Melissa Hansen, WSWC and Todd Murray, WSU

Figure #

The economic impact of SLF in its native range is mostly documented on yield impacts in Korean grapes and associated with photosynthetic loss due to sooty mold buildup (Leach et al. 2019). Upon its introduction in Pennsylvania, extreme examples of yield loss due to direct feeding were reported up to 90% by individual growers. Economic losses continue into the following season as new buds are revealing lower yield capacity and increased cold damage. Added costs associated with pest management programs have increased by three times (Urban 2020), further reducing the margin of profit for the grower.

Nearly all wine grapes are produced in eastern Washington, but the wineries that purchase the grapes are located throughout the state, from Seattle and Woodinville to Walla Walla. About 90 percent of the wineries are small producers, bottling less than 5,000 cases of wine annually. During harvest, winemakers utilize all modes of transport to bring fruit to their winery, from one bin in a pickup truck to rental trucks or to larger trailers. Quarantine restrictions could put a stranglehold on timely transport, scheduling, and crush operations, which are necessary for wineries to process fruit in a small window of time.

Washington state is #2 in the national production of wine grapes. In 2019, the farm gate value of grapes was $300 million. There are almost 60,000 acres of wine grapes and 400 wine grape growers in Washington state. Washington wines sold $2.5 billion in 2021 and have a direct, indirect, and induced total economic impact of $8.8 billion annually. Washington state is also a leader in Concord grape juice production with an estimated 157,000 tons produced in 2022 and a value of $407 per ton (Ball, T. 2022 personal communication). While the specific economic impact of SLF on Washington wine grapes is dependent on other variables, it is clear that the impact would be significant due to the size of Washington's wine and juicegrape industries.

Economic Impact to Washington Tree Fruit Industry

Written by Melissa Hansen, WSWC and Todd Murray, WSU

Washington state is a world leader in tree fruit production and export. In 2021, the tree fruit industry covered over 232,000 acres in Washington state, much of which are in apple production with some cherry and pear production. Washington state produces 93% of the United State's organic apples and leads the nation in sweet cherry production. About 75% of the nation's cherry production and nation's cherry exports come from the Pacific Northwest. The tree fruit industry is valued over $10 billion. Apples are valued at $3.18 billion after packing, and account for $7.5 billion in total economic impact. The apple industry in Washington State generates $848 million in state and local taxes and is a major employer for the state. Washington State exports over 24% of its fresh apple crop internationally and distributes fruit across the United States. SLF infestations in tree fruit producing regions would have a significant impact on the cost and ability to export fruit. Sustaining this is a significant feature of the state's economy.

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Economic Impact to Washington Hops Industry

Written by Melissa Hansen, WSWC and Todd Murray, WSU

Washington state is a major producer of hops, the green, cone-shaped flowers that give bitterness, flavor, and aromas to craft beers. Washington state accounts for almost 30% of the total world hop production. Nearly 43,000 acres of hops were harvested in Washington in 2022 with a farm gate value of $435 million. The Pacific Northwest is the largest growing region of hops in the world; Washington represents about 70 percent of the PNW production.

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Environmental Risk

Written by Fiona Smeaton, Samara Group

The impacts of an SLF invasion in Washington state could have significant implications on the environment as well as the economy. Due to its many host species there is the potential for SLF to cause serious damage to native and ornamental trees. Many street trees in cities across Washington will be subject to SLF damage. While it is rare for the insect to actually kill infested trees there is still significant damage done through its feeding behavior and excretion of honeydew. Additionally rural and open natural areas will likely see pockets of infestations that may be harder to track and yet potentially dangerous to native habitats. Continual feeding can greatly weaken host trees especially when combined with other stress factors such as drought or other pests. The falling honeydew can be detrimental to understory plants as it will create sooty mold and limit the plant species ability to photosynthesize.

Commented [7]: Should there be environmental considerations for treatment and response added as well? USDA APHIS is interested in how response will impact T&E species and the environment.

The greatest environmental danger from SLF will be in its ability to quickly spread and reproduce in new areas, especially agricultural settings. Once SLF arrive in an area they are very difficult to control and will spread through their own means and through human assisted activities. If there is TOH present the success and spread of the SLF will be even greater. As plant-hoppers, SLF are highly effective at moving between patches of host trees. The long term impacts of SLF are still unknown and will vary with different habitats, however, the short term effects on host trees, especially once dense infestations are established, make it clear that there will be significant damage done if efforts are not taken to control the spread of the insect into new environments.

Forest Impacts and Pathways

Written by Ya-Wen Ott, US Forest Service & Karen Ripley, US Forest Service

Although wild plant hosts of SLF in the U.S. are still relatively unknown, several native deciduous trees are found to be frequent hosts including maples (*Acer* spp.), walnuts (*Juglans* spp.), birches (*Betula* spp.), willows (*Salix* spp.), oaks (*Quercus* spp.), and ash trees (*Fraxinus* spp.) (Barringer and Ciafré 2020; Lavely et al. 2022). To our knowledge, SLF nymphs have only been found on one conifer in the U.S., northern white cedar (*Thuja occidentalis* L.), but it is uncertain if the tree is a feeding host (Barringer and Ciafré 2020). SLF nymphs were reported feeding on blueberries (*Ericaceae* spp.) (Barringer and Ciafré 2020) which might affect native shrubs such as Cascade blueberry, oval-leaved blueberry, evergreen huckleberry, small cranberry, and red huckleberry in Washington state. These berries are important food plants for birds and wildlife and cultural foods for Indigenous communities. Direct damage from SLF feeding and mold growth on excreted honeydew can diminish both the availability and quality of these berries.

Deciduous forest trees have rarely been killed by SLF, but occasional young saplings might die in response to long-term heavy feeding (Lavely et al. 2022). Even though SLF might not directly damage forest trees, SLF effects can be cumulative when trees are also stressed by other biotic

or abiotic factors, such as drought and heat stress (Barringer and Ciafré 2020; Lavely et al. 2022; Urban and Leach 2023). Overall, impacts of SLF on forest health should continue to be assessed as conditions change.

Figure #

Forests may also be a source of infestations when near high-risk locations such as vineyards, orchards, and tree nurseries (Urban and Leach 2023). Due to the sheer numbers of individual SLF present, some infestations can be a nuisance and disrupt forest recreation (Urban 2020; D. Mausel, personal communication). Furthermore, SLF egg masses, nymphs and adults can move easily along transportation pathways (Urban 2020), making quarantine, eradication, and slow-the-spread strategies difficult to execute in forests and across dispersed recreation sites.

Urban and Community Impacts

Written by Todd Murray, WSU

Urban and community impacts from SLF will depend directly on the response by regulatory agencies. Eradication programs can be initially costly when host plant material is removed from a delimited range of the infestation. Urban and community impacts would be high given the large host range of this pest due to the amount of host plant material that would need to be removed within the area that needed to be eradicated. The loss of canopy cover from removed street trees will have many detrimental effects on already overburdened communities. Street

trees have many benefits to communities including creating shade, mitigating air and noise pollution, providing habitat and creating visual appeal. Areas with already limited populations of street trees will be even more vulnerable to losing green spaces altogether.

Long-term urban and community impacts will be associated with the management of established populations of SLF. Costs and impacts would include tree and shrub replacement with resistant varieties or non-host species, chemical control of established populations to conserve plant health and avoid large inconvenience caused by honeydew deposition or aesthetic stress by large aggregations of feeding insects.

Cultural Resources

Written by Jessica La Belle, WISC
To be added before the final draft.

Human Health & Safety

Written by Fiona Smeaton, Samara Group

The SLF does not bite or sting humans and so does not cause direct impacts to human health and safety; however, there are indirect economic and environmental impacts. The insects themselves can cause a nuisance to communities as large infestations will swarm and interrupt outdoor activities (Murman et al. 2020). Infested trees will collect excreted honeydew which becomes sooty mold as the SLF adults pierce the woody plant tissue in order to reach the nutrient-rich phloem (PennState Extension, 2021). On warm or sunny days, large amounts of honeydew can fall like rain on outdoor and recreational equipment, as well as people that are in the area, which can significantly limit individuals' ability to access and enjoy outdoor or natural areas.

There are safety concerns from insecticides used to combat SLF and herbicides used to control its preferred invasive plant host, TOH. Pesticides are an important tool required for the control of invasive species; however, overuse or incorrect use can be unsafe for humans. Only pesticides registered by the Environmental Protection Agency (EPA), as well as for use in Washington state should be used to control SLF and TOH. Homemade pesticides can be dangerous to the environment and people alike (PennState Extension 2021). It is important to read all instructions and follow the application rate and protocols listed on the pesticide label. When treating SLF with insecticides it is essential to wear proper protective gear and limit exposure as much as possible. The danger to human health from insecticides depends on two factors, the toxicity of the insecticide and the amount in which the individual is exposed to (PennState Extension 2021). Using the least toxic insecticide that is still effective is the best way to reduce the risk to human health and safety. All insecticides are labeled with their toxicity level on the bottle.

Pesticide drift and runoff can cause chemicals to enter waterways and non-targets which may in turn lead to safety risks to humans. The style of application for pesticides will impact this. Trunk injections are more targeted and have a smaller chance of runoff into the surrounding

environment; however, they are only effective when adults are present and shouldn't be done in drought conditions. On the other hand, mist blowers (not likely to be used in this case), spray treatments or soil drenches are more likely to have pesticide drift, causing impacts to non-targets and humans applying the treatments. Application of pesticides using these strategies near waterways should be limited wherever possible (PennState Extension 2021). There are strict guidelines in place for pesticide applications near surface water and these will need to be evaluated on a case by case basis.

While removal of the SLF preferred host tree, TOH is commonly identified as the best strategy for controlling the insects, care should be taken during this removal process. Full coverage clothing can help to prevent burning or rashes on the skin from coming in contact with the leaves and sap. Those who are allergic to the TOH sap or pollen should take extra care when dealing with this tree. If TOH sap comes in contact with broken skin even more serious reactions can occur including fever, chest pain, shortness of breath and more depending on the individual's exposure and sensitivity to the plant (ISAC 2006).

The Department of Health (DOH) will be a valuable resource going forward for pesticides which may be used against SLF. An SLF page with fact sheets and contacts will be available on the DOH website.

Readiness (Pre-Incident Actions)

Preventative Measures

Written by Molly Darr, WSU & Josh Milnes, WSDA & Todd Murray, WSU

In a recent model, it was predicted that SLF would establish in California by 2033 without preventative management (Jones et al. 2022). While SLF cannot be prevented from coming onto your property, there are steps that can be taken to protect against infestation and damage. When choosing the best defense against SLF damage, recommendations are circumstantial, and specific to the landscape and host species landowners have targeted for protection. While the efficacy of preventative measures are still being investigated, current strategies largely consist of cultural control strategies like egg scraping, tree banding, trapping, protective barriers, and host tree removal (Liu 2019). Additional research on potential behavioral control methods like attractants, repellents, or mating disruption is needed (Urban and Leach 2023).

SLF lay their eggs in rows, which are then covered in a cement-like putty. Eggs can be laid on nearly any flat surface. Mechanical removal of egg masses is possible, and should be attempted in winter or early spring, after adults have died but before eggs hatch. Egg masses can be smashed with a stick, hand, or scraped with a credit card or knife blade. Unfortunately, mechanical removal of egg masses is often impractical as most egg masses are deposited in hidden places, or are out of reach in tree canopies (Liu 2019, Urban and Leach 2023) (Fig. # below). It is also important to look for egg masses on vehicles, camping equipment, trailers, and other flat surfaces that are stored outside before taking them across state lines. The movement

of infested materials is one of the most common ways SLF can be spread to new territories, and many states have ordered quarantine to prevent human assisted spread of SLF (Leach 2021a).

Glue traps, funnel traps, and sticky bands are sometimes employed for local management of SLF. While they may not be effective on a large scale, this may be a useful non-chemical control approach for small parcels of land like backyards. More research is needed to determine effects on population reduction (Leach 2021b). Exclusion netting can be used in agricultural settings to protect fruit trees and grape vines. Studies have shown this method results in up to 99.8% reduction of SLF populations on grape vines (Urban and Leach 2023).

Host tree removal may be effective on small properties or in residential areas. This can prevent the accumulation of honeydew and associated sooty mold, thereby preventing personal property damage (Leach 2021b). TOH is a preferred host plant of SLF, and is also an invasive plant species in the United States (Parra et al. 2017). Removal is recommended to prevent SLF infestations from spreading, though removal of preferred host plants has not yet been evaluated for SLF populations reduction (Leach 2021b). This approach may inadvertently increase pressure on other non-target host plants in the area (Urban and Leach 2023).

Figure #. SLF eggs are often deposited in cryptic locations and can be hard to see. A collection of egg masses are pictured here on the interior of a fence post. Photo: Lawrence Barringer, Pennsylvania Department of Agriculture.

Survey and Detection Protocols

Written by Yolanda Inguanzo, USDA

Approved survey methods for SLF have been developed by the Cooperative Agriculture Pest Survey Program (CAPS). The National CAPS program conducts exotic plant pest surveys through a national network of cooperators and stakeholders. The CAPS program also provides funding to states and local agencies to conduct surveys. There is additional funding through the Plant Protection Act (PPA) programs. There are 2 surveys funded through PPA in Washington state that include SLF as a target, they are *Grape Commodity Survey*, and *Pathway Survey for Pests of Multiple Agricultural Systems.* These surveys have a list of bundled target pests included in them in addition to SLF. Bundled surveys are encouraged in the CAPS and PPA programs to survey for multiple pests that can be found in the same place with the same hosts, as this is a cost-effective way to get more surveys done with limited funding. A requirement for the use of CAPS and PPA funding is that the approved survey method must be used, and one important function of the CAPS program is the development of science-based survey methods. The approved method for SLF is visual survey, there is no approved trap and lure at this time.

Visual survey for feeding damage

SLF is large and its appearance is unlike any other insect. Surveyors should become familiar with all life stages including egg masses. Having real specimens and pictures might be helpful for surveyors to become familiar with what they look like. Signs and symptoms of feeding damage may identify where closer visual surveys should be done, although signs of feeding damage alone are not a positive detection. Signs of feeding damage include: wilting plants, weeping wounds of sap on trunks, honeydew on leaves, sooty mold, understory mold growth under affected foliage, and increased activity of wasps, hornets, bees, and ants feeding on honeydew.

Nymphs (Fig. #) and adults (Fig. #) are typically found in aggregations on the branches and trunk of a host plant. Early instar nymphs are not host specific and can be found on woody and non-woody plants (Dara et al., 2015). As the nymphs mature to fourth instars and adults, the host range narrows significantly and the majority of individuals migrate to the TOH (Dara et al., 2015). The fourth instar nymphs (red nymph) and adults are the most distinct and easily detected life stages. Identifying symptoms of feeding damage may be useful in areas of low density.

Survey for egg masses

Searching for egg masses is an important part of a visual survey. Egg masses are apparent before they hatch and after hatching older egg masses may be found. They can be deposited on any surface such as buildings, vehicles, sheds, and trees. Egg masses have also been found under outdoor items and under loose bark. In Pennsylvania, SLF overwinters in the egg stage, the first egg masses have been found in late September to October. Phenology in the Pacific Northwest may be slightly different but surveys for egg masses can be done through the year. Surveyors should become familiar with the appearance of egg masses at all stages by looking at pictures of newly deposited, and older hatched egg masses. Surveyors should examine all surfaces, examine tree trunks and bark carefully and up close, and lift and look under objects.

Figure # New (right) and hatched (left) egg mass of Lycorma delicatula (Miram Cooperband, USDA APHIS).

Commented [8]: this section would be good to include the North Carolina observation that egg masses are more readily identifiable after rain or morning dew, as tree bark changes color when wet so the egg masses stand out more. would need creative citation from the stopslf.org virtual summit's NC presentation

Survey for immature life stages
Early instars (1-3) are black with white spots and occur in spring to early summer. Fourth instars are bright red and distinctive. Surveyors should examine all parts of the plant carefully, including stems and undersides of leaves. For large trees, binoculars may be helpful to examine the upper canopy. Negative data may be reported if fourth instar nymphs or adults are not found and no feeding damage symptoms are observed when host material is inspected between July and November.

Figure # Miriam Cooperband, USDA APHIS

Survey for adults

Adults have gray forewings with black spots and reticulated tips. The hindwings have contrasting blocks of red and black with a white stripe partially dividing them.

Figure #

Survey site selection

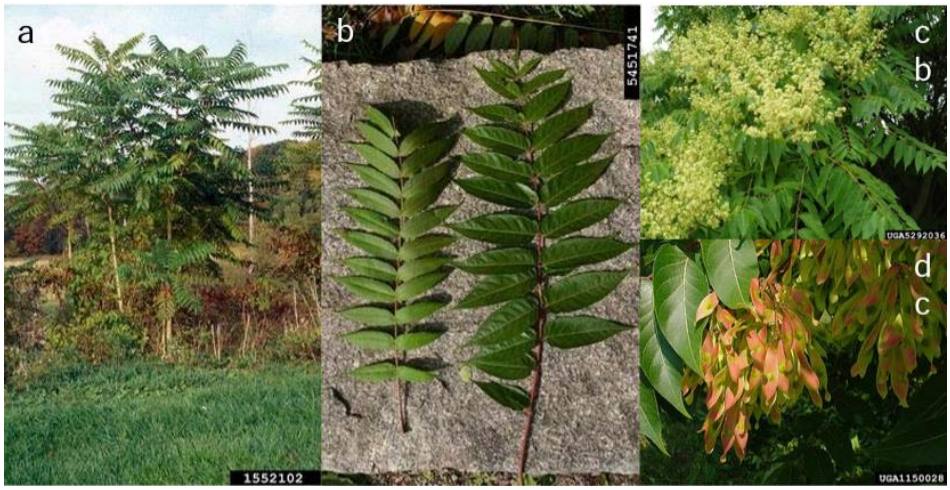
Surveys should be conducted in grape vineyards; tree fruit orchards; and high-risk areas, including wholesale and retail distributors of natural and artificial outdoor products, utility and transportation right-of-ways, construction companies and contractors, landscapers, and loggers and firewood dealers. TOH is a sentinel plant for visual survey and inspection for SLF. Particular attention should be made on TOH found in pathway areas at risk of SLF introduction.

Tree-of-heaven identification

TOH is an exotic plant, invasive in eastern Washington, and while it is less common west of the Cascade range there are many isolated or small clumps of trees throughout western Washington. It is preferentially found in disturbed areas, including roadsides, forest edges, fencerows, and fields. TOH has alternate, compound leaves, and each leaflet has one or more glandular teeth along the lower margin. (see photo) Crushed leaves and flowers have an unmistakable scent of rancid peanut butter. Flowers occur in large terminal clusters and are small and pale yellow to greenish. Flat, twisted, winged fruits each containing a single central seed are produced on female trees in late summer to early fall and may remain on the trees for long periods of time.

Figure #

(a) Tree of heaven thicket (b) leaves (c) flowers (d) seeds(All photos from Bugwood.org (a)Catherine Herms, The Ohio State University (b) Leslie J. Mehrhoff, University of Connecticut
(c) Jane Samanek, Phytosanitary Administration (d) Chuck Bargeron, University of Georgia



Preparedness Funding

Written by Justin Bush, WISC & Greg Haubrich, WSDA

The State of Washington believes that prevention and preparedness is the best approach to invasive species management, requiring far less resources than initial response, long-term management, and restoration. As such, Washington is taking a unified approach to funding activities to prevent SLF and prepare for response. This unified approach has sought and received funding from a variety of organizations including:

- Columbia Gorge Cooperative Weed Management Area
- Washington State Legislature
- Washington State Department of Agriculture
- Washington Department of Natural Resources
- U.S. Department of Agriculture Forest Service (USFS)
- U.S. Department of Agriculture Animal and Plant Health Inspection Service Plant Protection and Quarantine (USDA APHIS PPQ)

Starting in 2018, the Washington State Department of Agriculture began visual surveys for SLF at vineyards statewide using a combination of state and federal funds from USDA APHIS PPQ and USFS. Such surveys continue as a strategy of early detection and rapid response. Cumulatively, more than $550,000 has been directed, in part, to SLF surveys since 2018.

Rapid response preparedness activities to date include a bi-state Oregon and Washington functional exercise and full-scale exercise in 2019, followed up with a 2022 Washington State SLF tabletop exercise focusing on state roles and authorities, facilitated by the Washington Invasive Species Council with funding from the USDA APHIS PPQ. These preparedness activities laid the groundwork for this SLF action plan, funded by USDA APHIS PPQ. Full accounting of costs is undetermined; however, Washington's exercise is estimated to have cost approximately $15,000.

The preparedness strategy of identifying TOH began in 2020, building momentum toward a Washington Invasive Species Council-led statewide TOH census in 2021 that mobilized first detectors and citizen scientists statewide to inventory and report TOH in addition to visually surveying trees for SLF. The census resulted in 375 reports statewide in addition to determining presence in 8 counties where populations were previously undocumented. Additional surveys have been funded by the Washington State Department of Agriculture, passing more than $80,000 in funding to counties and other local cooperators since 2021.

Preparedness funding also includes pilot control projects to assist landowners led by the Forest Youth Success program in Skamania County, funded by the Columbia Gorge Cooperative Weed Management Area including an adjacent pilot control project led by the Underwood Conservation District in White Salmon and Bingen, Washington funded by the Washington Department of Natural Resources and Columbia Gorge Cooperative Weed Management Area. Both pilot projects have a cumulative cost of $38,375.

Additional preparedness needs fall into the following categories:

1. Survey and Inventory
2. Tree-of-Heaven Mapping and Removal
3. Public Education and Outreach

The Washington State Department of Agriculture is actively seeking funding from the State Legislature in addition to seeking funding from the U.S. Department of Agriculture through a Specialty Crop Block Grant, however, full preparedness funding needs have not been identified. Through development of the action plan, Washington state agencies and partners will document resource needs and intend to collaborate and seek funding for full implementation.

Response

Planning and Response Strategy

Figure #

Planning Assumptions

Written by Erin Coyle, WSDA & Sven-Erik Spichiger, WSDA

Washington state recognizes SLF as a plant and forest health threat with potential to severely endanger the agricultural or horticultural industries of the state. A detection of this pest may result in a plant health emergency compromising economic well-being, viability of natural resources, and environmental and public health. Numerous local, state, federal, educational institutions, and industry organizations may play a role in responding to and eradicating SLF as a declared state emergency. A plant or forest health emergency may significantly restrict the intrastate, interstate, and international movement of nursery stock and other plant products. It is assumed multi-agency legal authorities and funding will be required to provide a sufficient level of resources to conduct an effective plant pest mitigation response.

Agencies, organizations, and individuals identified in this planning effort are familiar with the content including response strategies, regulatory authorities, policies, and resource limitations. Entities identified in this plan will coordinate on execution of response actions, including the timely reporting of plant health emergencies.

Response Strategy

Written by Erin Coyle, WSDA & Sven-Erik Spichiger, WSDA

Response to invasive plant pests fall under the jurisdiction of Washington State Department of Agriculture Plant Pest Program. Plant health incidents may overwhelm local or single organization/agency resources and be of such scale that existing agreements may not provide an adequate response. All responses are guided by an Integrated Pest Management (IPM) approach.

Response and control efforts could involve the destruction of affected plants, products, and other materials that cannot be thoroughly cleaned and disinfected. Widespread biosecurity control measures may be implemented. Suspected infected locations and transport vehicles may need to be cleaned and disinfected. Quarantine may be required of areas where there are confirmed or suspect cases. Special operational procedures within these zones may be required. Law enforcement may be required for quarantine enforcement.

Response Authorities and Regulatory Policies

Written by Erin Coyle, WSDA & Sven-Erik Spichiger, WSDA

Washington State Legislature Title 38 Revised Code of Washington (RCW) (RCW 38.52) mandates the use of the standardized Incident Command System (ICS) in all multi-agency (federal, state, and local) or multijurisdictional incidents and emergencies. In participation with local, state, and federal agencies, the use of the standardized ICS system for an expanding SLF response and IPM implementation may be applied with scalability and flexibility.

Washington State Department of Agriculture has several authorities and responsibilities under RCW Title 17 that would apply if SLF is detected in Washington state. Specific and relevant rules are mentioned in this section RCW 17.24:

RCW 17.24.003
Purpose.
The purpose of this chapter is to provide a strong system for the exclusion of plant and bee pests and diseases through regulation of movement and quarantines of infested areas to protect the forest, agricultural, horticultural, floricultural, and apiary industries of the state; plants and shrubs within the state; and the environment of the state from the impact of insect pests, plant pathogens, noxious weeds, and bee pests as well as the public and private costs that result when these infestations become established.

RCW 17.24.041

Power to adopt quarantine measures—Rules.
If determined to be necessary to protect the forest, agricultural, horticultural, floricultural, beekeeping, or environmental interests of this state, the director may declare a quarantine against an area, place, nursery, orchard, vineyard, apiary, or other agricultural establishment, county or counties within the state, or against other states, territories, or foreign countries, or a portion of these areas, in reference to plant pests, or bee pests, or noxious weeds, or genetically engineered plant or plant pest organisms. The director may prohibit the movement of all regulated articles from such quarantined places or areas that are likely to contain such plant pests or noxious weeds or genetically engineered plant, plant pest, or bee pest organisms. The quarantine may be made absolute or rules may be adopted prescribing the conditions under which the regulated articles may be moved into, or sold, or otherwise disposed of in the state.

RCW 17.24.101
Statewide survey and control activity.
If there is reason to believe that a plant or bee pest may adversely impact the forestry, agricultural, horticultural, floricultural, or related industries of the state; or may cause harm to the environment of the state; or such information is needed to facilitate or allow the movement of forestry, agricultural, horticultural, or related products to out-of-state, foreign and domestic markets, the director may conduct, or cause to be conducted, surveys to determine the presence, absence, or distribution of a pest. The director may take such measures as may be required to control or eradicate such pests where such measures are determined to be in the public interest, are technically feasible, and for which funds are appropriated or provided through cooperative agreements.

RCW 17.24.111
Director's cooperation with other agencies.
The director may enter into cooperative arrangements with a person, municipality, county, Washington State University or any of its experiment stations, or other agencies of this state, and with boards, officers, and authorities of other states and the United States, including the United States department of agriculture, for the inspection of bees, plants and plant parts and products and the control or eradication of plant pests, bee pests, or noxious weeds and to carry out other provisions of this chapter.

RCW 17.24.171 - Determination of imminent danger of infestation of plant pests or plant diseases—Emergency measures—Conditions—Procedures.
(1) If the director determines that there exists an imminent danger of an infestation of plant pests or plant diseases that seriously endangers the agricultural or horticultural industries of the state, or that seriously threatens life, health, economic well-being, or the environment, the director shall request the governor to order emergency measures to control the pests or plant diseases under RCW 43.06.010(13). The director's findings shall contain an evaluation of the effect of the emergency measures on public health.
(2) If an emergency is declared pursuant to RCW 43.06.010(13), the director may appoint a committee to advise the governor through the director and to review

emergency measures necessary under the authority of RCW 43.06.010(13) and this section and make subsequent recommendations to the governor. The committee shall include representatives of the agricultural industries, state and local government, public health interests, technical service providers, and environmental organizations.
(3) Upon the order of the governor of the use of emergency measures, the director is authorized to implement the emergency measures to prevent, control, or eradicate plant pests or plant diseases that are the subject of the emergency order. Such measures, after thorough evaluation of all other alternatives, may include the aerial application of pesticides.
(4) Upon the order of the governor of the use of emergency measures, the director is authorized to enter into agreements with individuals, companies, or agencies, to accomplish the prevention, control, or eradication of plant pests or plant diseases, notwithstanding the provisions of chapter 15.58 or 17.21 RCW, or any other statute.
(5) The director shall continually evaluate the emergency measures taken and report to the governor at intervals of not less than ten days. The director shall immediately advise the governor if he or she finds that the emergency no longer exists or if certain emergency measures should be discontinued.

RCW 17.15.020

Implementation of integrated pest management practices.
Each of the following state agencies or institutions or county agencies shall implement integrated pest management practices when carrying out the agency's or institution's duties related to pest control:
(1) The department of agriculture;
(2) The state noxious weed control board;
(3) The department of ecology;
(4) The department of fish and wildlife;
(5) The department of transportation;
(6) The parks and recreation commission;
(7) The department of natural resources;
(8) The department of corrections;
(9) The department of enterprise services;
(10) Each state institution of higher education, for the institution's own building and grounds maintenance;
(11) Each county noxious weed control board; and
(12) Each weed district.

Response if Detection Occurs on Federal Forest Land

Written by Ya-Wen Ott, US Forest Service & Karen Ripley, US Forest Service

The U.S. Forest Service (USFS) will respond with a risk assessment if the detection of SLF occurs on federal forest land. The risk of SLF damaging native tree species is considered relatively low and its impact to forest health in the eastern U.S. has been minor (Lavely et al. 2022; D. Mausel, personal communication). Currently, SLF is recognized as a human nuisance

pest in the ~~eastern~~ USFS Eastern R~~r~~egion (Region 9). Therefore, USFS priorities do not allow~~include~~ SLF survey, eradication, suppression, or new monitoring projects under Forest Service Handbook (FSH) 6509.11g 22:

> **FSH 6509.11g 22.12 Prevention, Suppression, Eradication, and Restoration**
> Use SPFH and SPS4 funds to prevent and reduce unacceptable tree and forest resource losses by suppressing forest insects and diseases eradicating isolated infestations of gypsy moth. Management of the European gypsy moth and invasive plants in tropical forests, and restoration of National Forest System lands damaged by forest insects and diseases, must be in accordance with the USDA Forest Service and APHIS Memorandum of Understanding.
>
> **FSH 6509.11g 22.14 Other Uses**
> State and Private Forestry programs help facilitate:
> Pest Quarantine Enforcement. Use SPFH and SPS4 funds to work with and support the Animal and Plant Health Inspection Service quarantine enforcement activities. Such activities involve forest insects and diseases on National Forest System lands, affecting trees and forests, wood projects, stored wood, and wood-in-use.
>
> **FSH 6509.11g 22.3 Prohibited Uses of Forest Health Management Funds**
> Nuisance Insects. Do not use funds to finance the suppression of insects that are primarily a nuisance to people and do not damage trees, forests, wood products, stored wood, or wood-in-use. Nuisance insects include pests such as: flies, mosquitoes, gnats, yellow jackets, and black flies.

The USFS involvement will mostly focus on TOH and SLF impacts on forest overstory and understory plants.The USFS will continually review the SLF risk to forests, its role in the SLF response, and the need for monitoring, pest alerts, and management guidelines. If the SLF risk to forests changes in the future, and it is no longer recognized merely as a human nuisance pest in forests, then USFS funds could be used on SLF directly.

Response Structure

Written by Erin Coyle, WSDA & Sven-Erik Spichiger, WSDA

Concept of Operations

WSDA is the primary state agency with statutory authority pertaining to plant industry issues and routinely conducts detection surveys for exotic plant pests as well as investigations of reported and/or suspected new detections. When a plant pest is discovered, WSDA coordinates the communication of new plant pest information with the United States Department of Agriculture, Animal and Plant Health Inspection Service, Plant Protection Quarantine (USDA APHIS PPQ), all Primary and Supporting Agencies, as well as other appropriate state and federal agencies, state academic institutions, and industries.

WSDA, acting within its statutory mandate, will respond to such incidents in coordination with federal, state and local agencies, and may coordinate with the State Emergency Operations Center (SEOC) for activation of Emergency Support Function (ESF) #11 as needed. WSDA as the Coordinating Agency will notify all Primary and Support Agencies of their needed support when ESF #11 is activated. Under the activation level set by the SEOC, response and recovery activities will be consistent with the Washington State Comprehensive Emergency Management Plan (CEMP) and Washington Restoration Framework and these activities will be governed by WSDA procedures.

State Emergency Response Organization

As the lead organization assigned to plant health and pest emergencies in Washington state under the Comprehensive Emergency Management Plan (CEMP), WSDA coordinates plant health services and provides direction and control of allied associations and agencies assisting in emergencies and disasters. A comprehensive overview of the organizational structure for state responses to emergencies, coordinated with or supported through the State Emergency Operations Center, is detailed in the Washington State Comprehensive Emergency Management Plan found at: https://mil.wa.gov/plans.

Unified Coordination Group

With a positive detection of SLF in the state of Washington, WSDA and WISC Executive Coordinator may establish a Unified Coordination Group (UCG) among cooperating agencies to coordinate decision making and resource allocation. The UCG may establish incident priorities with input from other local, state, and federal agencies with legal responsibility for the protection of natural resources, agriculture, and plant and forest health. This group will coordinate with the Incident Management Team(s), if any are used, and may include representatives from industry and stakeholder groups as appointed by the core coordinating authorities of this plan.

Membership of this group may consist of representatives of the following agencies:

- Washington State Conservation Commission
- United States Department of Agriculture
- Washington Invasive Species Council
- WA State Noxious Weeds Coordinators Association
- Washington State University
- Washington Noxious Weed Control Board
- United States Forest Service
- Washington State Department of Agriculture
- Other organizations as identified

Incident Management Team

The unified command, consisting of state and federal agencies, may choose to activate an Incident Management Team (IMT). Priorities for this team will be set forth by the Multiagency Coordination Group (MAC-G). This team will consist initially of WISC, WSDA, USFS, USDA,

and SCC. As the incident expands, additional personnel may be added along with additional positions to help manage the incident. Incident Command, during or in advance of an incident, may utilize an Incident Complexity Analysis Tool to assess the complexity, severity, and scope of the response to determine if the incident can be managed effectively with current interagency staff or if staffing resources need to be expanded and a regional IMT or USDA IMT should be requested for support.

Quarantine/Regulation – Enforcement and Compliance

Written by Sven-Erik Spichiger, WSDA & Erin Coyle, WSDA

WSDA is the lead agency for implementation of the regulatory plant pest control response and for maintaining appropriate state quarantines. Response activities are led by WSDA and may be done so in unified command with USDA APHIS PPQ. WSDA reviews and coordinates control activities to ensure compliance with local, state, and federal laws and initiates timely response and recovery measures. If determined to be necessary to protect the forest, agricultural, horticultural, floricultural, beekeeping, or environmental interests of this state, RCW 17.24.041 outlines the authority of WSDA to adopt quarantine measures. If SLF is detected in Washington, the director of WSDA may declare a quarantine against any of the following in reference to this plant pest:

- Area
- Place
- Nursery
- Orchard
- Vineyard
- Apiary
- Other agricultural establishment
- County or counties within the state, or against other states
- Territories
- Foreign countries
- Or a portion of these areas

The director may also prohibit the movement of all regulated articles from such quarantined places or areas that are likely to contain SLF. The quarantine may be made absolute or rules may be adopted prescribing the conditions under which the regulated articles may be moved into, sold, or otherwise disposed of in the state.

Emergency Funding and Long-Term Management of Spotted Lanternfly

Written by Justin Bush, WISC & Greg Haubrich, WSDA

In the State of Washington, new invasive species are considered an emergency and are responded to as such. The economic, environmental, and cultural impacts of SLF are known to be vast and devastating. The general state approach is that of emergency funding, meaning

resources required for initial attack to the confirmed detection of SLF for the purpose of immediate containment, with a goal of eradication. Secondly, if SLF becomes established, the general approach is containment through regulatory processes and enforcement paired with long-term control costs to suppress populations to the lowest level possible.

Upon initial confirmation that SLF is present in Washington, State Department of Agriculture Pest Program staff will brief the department director and make a recommendation on the imminent danger of an infestation of plant pests or plant diseases that seriously endangers the agricultural or horticultural industries of the state, or that seriously threatens life, health, economic well-being, or the environment per Revised Code of Washington (RCW) 17.24.171. The director will review presented information, the staff recommendation, and determine if emergency measures are required through development of findings. Upon determination of imminent danger, the director shall request the governor to order emergency measures to control the pest.

If an emergency is declared, the director will be requested to appoint SLF Preparedness Advisory Group members as a committee to advise the governor through the director and to review emergency measures necessary and make subsequent recommendations to the governor. The committee shall include representatives of the agricultural industries, state and local government, public health interests, technical service providers, and environmental organizations.

Upon the order of the governor of the use of emergency measures, the director is authorized to implement the emergency measures to prevent, control, or eradicate plant pests or plant diseases that are the subject of the emergency order. Such measures, after thorough evaluation of all other alternatives, may include the aerial application of pesticides. The emergency order shall direct the Department of Agriculture to begin implementation of emergency measures, as necessary, to affect the eradication of or to prevent the permanent establishment and expansion of the SLF. The order should also direct the Department of Natural Resources, Washington State Department of Transportation, and the State Parks and Recreation Commission, to identify SLF management as a high priority on their respective state-owned lands and to facilitate implementing emergency measures. Finally, the order should urge the State Legislature to provide additional emergency funding as requested by the WSDA as soon as possible.

Concurrently, the Washington State Department of Agriculture will develop emergency funding requests to the U.S. Department of Agriculture, including the Forest Service, and Animal and Plant Health Inspection Service Plant Protection and Quarantine. The Washington Invasive Species Council will convene a special meeting for the purpose of briefing all member organizations on the situation and collaboratively identify additional funding sources to assist response.

Per state law, the WSDA director shall continually evaluate the emergency measures taken and report to the governor at intervals of not less than ten days. The director shall immediately

advise the governor if he or she finds that the emergency no longer exists or if certain emergency measures should be discontinued.

At such time that the WSDA determines that emergency measures and efforts to eradicate initial populations have failed and should be discontinued, the strategy will transition to containment through regulatory processes and enforcement paired with long-term control costs to suppress populations to the lowest level possible. At that time, WSDA, with assistance from the emergency measures committee and Washington Invasive Species Council, shall develop a 5-Year management plan and budget for submission to the State Legislature for funding. Upon completion of the plan, the WSDA, with assistance from the emergency measures committee and Washington Invasive Species Council, shall hold a statewide forum to review accomplishments, current research, and collect industry and public feedback to inform objectives for an updated 5-Year management plan and budget.

Management

Spotted Lanternfly Treatments

Written by Rian Wojahn, WSDA

Integrated Pest Management (IPM) and best available science will help guide the SLF treatment process. Factors such as SLF life stage, host plant(s), location (i.e. forest, agricultural, industrial, residential, etc.) and environment will need to be considered before SLF treatments transpire. It is highly important to be thoughtful throughout the process.

Treatment options against SLF continue to grow. However, selected treatment(s) must match the proper SLF life stage. Figure # below provides information on treatment and timing once SLF is detected in Washington state. Treatments include egg mass scraping, crushing, high-pressure water spraying, Golden Pest Spray Oil or similar, the contact insecticide Bifenthrin or similar, and systemic insecticide Dinotefuran or similar. An “outside the box” option is vacuuming, which has been used successfully in the northern giant hornet eradication program. It’s important to remember that many decisions must be made and treatments likely won’t start right away. They also may not necessarily take place throughout each window of time. All insecticides must be registered by the Environmental Protection Agency (EPA) and listed for use in Washington state. Applications must be made according to the label and by a certified applicator. Certain products may also be certified for use by the Organic Materials Review Institute https://www.omri.org

Figure #: Treatment timing

Management/Treatment Options	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
Scrape, smash or use high-pressure water to remove egg masses												
Treat egg masses with Golden Pest Spray Oil* or similar												
Contact insecticide application(s) (**nymphs and adults**)												
Systemic insectide application(s) (**adults**) tree and soil injections												
Vaccuming (**hatch until adult**)												

*soy bean oil (food grade)

Leach H, Walsh B, Swackhamer E, Korman A. 2021. Spotted lanternfly management guide. Penn State Extension, May 19.

Products and equipment will be staged at a central location. Before leaving for the SLF detection site ensure all required personal protective equipment (PPE) has been loaded. If insecticide treatments will occur, a safety plan, spill kits, and insecticide application recording forms need to be on-site. Furthermore, check with individuals already on-site to confirm additional resources are not needed. All treatments will be done in cooperation with another entity or entities. Areas such as railroad rights-of-way may involve a contractor.

Tree-of-Heaven Control

Written by Jennifer Mendoza, WA NWCA & Anne Schuster, WA NWCB

Tree-of-Heaven Identification

TOH, is a fast-growing, medium-sized tree in the family Simaroubaceae. The trees can grow over 30 meters in height, and can grow one meter a year, in the right conditions (Kowarik and Säumel 2007). The trees spread by root suckers, sprouts from cut trunks, and by seed. Due to their root sprouts, TOH frequently form thickets (Washington State Noxious Weed Control Board 2011). Individuals can live for 30-50 years, and occasionally over 100 years, though thickets can live indefinitely (Burch and Zedaker 2003).

Trees grow in a wide variety of habitats, though are frequently found in forest edges and disturbed sites, such as fence rows, roadsides, along railroads, in abandoned lots, and in urban plantings. TOH is very drought tolerant, and can be shade tolerant, though they prefer open, sunny areas. They can grow in mature second-growth forests, riparian areas, grasslands, and between cracks in concrete (Kowarik and Säumel 2007).

TOH has a deep taproot, along with many lateral roots, which can spread over 30 meters long (United States Forest Service 2014).

The stems are yellow to chestnut brown, with a pith center. Young stems are pubescent, covered in very small, light hairs, though the bark ages to be smooth. The branches have heart-shaped leaf scars, with a round bud shape at the sinus. The trunk and older stems have smooth, gray bark, with shallow diamond-shaped fissures (Washington State Noxious Weed Control Board 2011).

The leaves are made up of 11-27 leaflets. The leaflets grow opposite along the midrib of the leaf, with a single leaflet at the tip. Each leaflet is ovate-lanceolate in shape, with a rounded base, but otherwise has smooth margins. Each leaflet can grow 4-15cm long. The base of each leaflet has 1-3 rounded lobes, the underside of which each has a conspicuous gland. The entire leaf, which can be up to 1 meter in length, grows alternately up the stems (Hitchcock and Cronquist 1973). The foliage smells like peanut-butter, rotten peanut-butter, popcorn, or vomit when lightly crushed (Washington State Noxious Weed Control Board 2011).

Trees are mainly dioecious, with male and female flowers on separate plants. The male and female flowers look similar, though the inflorescences of male flowers are generally larger and have more flowers, while the female flowers can have sterile stamens. The flowers grow in large panicles, 10-30cm wide, at the ends of stems. They typically bloom late May through the end of July. The individual flowers are white to light-green, 6-8mm wide, have 5 petals, and have 5

sepals. Males have 10 stamens, while females may have 5 or 10 sterile stamens. Trees usually begin flowering at 3-5 years old (Kowarik and Säumel 2007).

The flowers develop into oblong samaras, which are 3-5 cm long and 1.15cm. These loosely twisted samaras have 1 centrally placed seed (Kowarik and Säumel 2007). The samaras start green and age to pale tan, yellow, or red-brown, becoming the most obvious around September. Like a maple samara, these seed pods can easily spread on the wind (Washington State Noxious Weed Control Board 2011). The seeds are short-lived in the seed bank, as they can only survive and be viable for around 1 year (Kota et al. 2007). Trees produce the most seed when 12-20 years old (Kowarik and Säumel 2007).

There are a few trees that can be confused with TOH. Smooth sumac (*Rhus glabra*), staghorn sumac (*Rhus typhina*), and black walnut (*Juglans nigra*) all have similarly-shaped leaves with many leaflets. However, all 3 of these species' leaflets have serrated edges, solid stems, and no peanut-butter smell. The sumacs' inflorescences are made of much smaller flowers than TOH. They will form dense cone-shaped bundles of seed, which are usually red to red-brown and have a velvet-like appearance. The sap from sumacs can be very milky in appearance. Walnut trees' bark is very rough, with vaguely rectangular fissures. The catkin inflorescences will form large green walnuts (Burke Herbarium, 2022).

Manual and Mechanical Tree-of-Heaven Control

Small plants can be hand pulled, but all root fragments must be removed. Digging may be required, as small plants can grow large root systems quickly, which are difficult to remove, and will resprout if left in the soil (Kowarik and Säumel 2007).

Cutting or mowing alone will not kill seedlings, root sprouts, saplings, and trees, due to how readily roots and stumps sprout. Cutting and mowing can stimulate more growth. An herbicide treatment is required for successful control of TOH when using any cutting or girdling method (Constán-Nava et al. 2010).

Any stems left in contact with moist soil can resprout roots and shoots from nodes (Washington State Noxious Weed Control Board, 2011), so all plant parts should be disposed of properly. This can include burning, wood chipping, and putting stems and branches in landfill garbage. Small amounts of plant matter can be put in thick trash bags that do not let light through, before putting in the garbage. It should be noted that many municipalities' composting facilities do not get hot enough to kill all plants or seeds.

Biological Tree-of-Heaven Control

Grazing can be used to kill TOH stems and weaken the roots, but is not a long-term solution as it does not kill the roots and the tree can continually resprout (Burch and Zedaker 2003). Grazing can cause illness in livestock if TOH makes up too great a percentage of forage (S. Bird, personal communication December 6, 2022).

Research is being conducted on potential insect and fungal pathogens, though currently there are no approved biological controls for TOH (Washington State Noxious Weed Control Board 2011).

Cultural Tree-of-Heaven Control

It may be possible to shade out and discourage establishment of TOH seedlings by establishing a thick canopy of trees or by growing a dense grass sod (Washington State Noxious Weed Control Board 2011). A thick weed tarp may also be effective.

Fire, either prescribed burns or wildfire, can increase TOH seed establishment due to opening areas to infestation (Guthrie et al. 2016). Following fire, restoration with competitive and desired plants would be needed in areas prone to TOH invasion.

Chemical Tree-of-Heaven Control

Foliar treatment is the method of choice for controlling TOH. Combining glyphosate (3 quarts per acre) with triclopyr 3 lb./gal. (2 quarts per acre) or triclopyr 4 lb./gal. (1.5 quarts per acre) will give the best control results. This is a non-selective treatment that will harm any plant that might be below the TOH, or that the herbicide might spray or drip onto. This treatment is best done in July, until the TOH leaves start to change color in the fall (Pennsylvania State Extension 2020).

Basal bark treatment is effective when done from July until the TOH's leaves start to change color in fall. Triclopyr ester should be used, either ready to use or at 20%, 1:4 in basal oil. The herbicide should be applied directly to the bark of the tree, in a continuous band 30cm-45cm wide, around the entire circumference of the tree, near the base of the tree. This is only effective on stems that are 15 cm and under in diameter. Larger stems and trees should be treated with the hack and squirt method (Pennsylvania State Extension 2020).

The hack and squirt method is also best done from July until the TOH leaves start to change color in the fall. Use glyphosate or triclopyr diluted 1 to 1 with water. Do not completely girdle the tree, as this will not allow the herbicide to reach the roots. Make periodic hacks around the tree. A good guideline is having one hack per inch of diameter. Immediately squirt herbicide into each hack, filling the cut. This method is not very effective on stems less than 1 inch in diameter (Pennsylvania State Extension 2020).

If a tree must be removed, a cut stump treatment can be effective, though is not nearly as successful as the above methods. It is better to use a foliar, basal bark, or hack and squirt treatment and wait for the herbicide to begin to take effect before cutting down a tree (Pennsylvania State Extension). It is better to treat a stump when cutting a TOH down, rather than leave it completely untreated, as root suckers can sprout up more than 30 meters away after a tree is cut down. Triclopyr ester or imazapyr with bark or crop oil (33:67 to 50:50 mixture ratio) should be applied to the surface of the stump within 5 minutes of cutting the tree. Due to the lower efficacy rate of this method, follow up monitoring and maintenance will be needed to control any sprouts up to 30 meters away from the originally treated tree (United States Forest Service 2014).

With any herbicide use, regulations that apply to the specific area and herbicide label directions should be rigorously followed. Only the herbicide(s) appropriate for the habitat, time of day, season, and method of application should be used. Appropriate personal protective equipment should be utilized and herbicide storage and disposal methods followed per the label and/or the safety data sheet (SDS).

Biological Control of Spotted Lanternfly

Written by Molly Darr, WSU

Biological control will likely be an important component of an integrated pest management approach for SLF. Mammals, fish, birds, and insects have all been observed feeding on SLF in the U.S., though population impact has not been determined. It is thought that SLF may sequester toxins from the plant hosts it feeds on, which may limit its palatability to potential predators (Dara et al. 2015). However, several potential biological control agents have been identified, including entomopathogenic fungi and two subspecies of native parasitoids. Conservation or augmentative biological control approaches could be a viable long-term management strategy, but further research is needed to study SLF in its native range to better understand SLF behavior and identify additional natural enemies (Lee et al. 2019).

Parasitoids

Ooencyrtus kuvanae Howard (Hymenoptera: Encyrtidae) has been found to parasitize SLF eggs, though it is not endemic to the U.S. *Ooencyrtus kuvanae* is primarily an egg parasitoid of spongy moth, and more research is needed to determine nontarget effects and potential impact on SLF populations if introduced (Liu and Mottern 2017). *Anastatus orientalis* Yang & Choi (Hymenoptera: Eupelmidae) (Fig. #) and *Dryinus sinicus* Olmi (Hymenoptera: Dryinidae) are both endemic to the native range of SLF and are currently under evaluation in quarantine. *Anastatus orientalis* is an egg parasitoid thought to significantly impact SLF populations in South Korea, and has been successfully reared in a controlled environment. Investigation of the nymphal parasitoid *D. sinicus* is still in the early stage, as rearing efforts have been less successful in quarantine (Urban and Leach 2023).

Entomopathogenic fungi

Baktoa major, Beauveria bassiana, Metarhizium pemphigi and *Ophiocordyceps delicatula* are all native entomopathogenic fungi that have been documented attacking SLF in the U.S (Clifton et al. 2021). *Beauveria bassiana* is already marketed as a commercialized biopesticide and would be a relatively simple addition to an SLF control program (Clifton et al. 2020). Both *B. bassiana* and *B. major* are known to have caused a reduction in SLF populations in targeted areas of SLF's invasive range, but further research is needed to determine area-wide efficacy. *Metarhizium pemphigi* and *O. delicatula* were both discovered in southeastern Pennsylvania, where *B. bassiana* and *B. major* were present, and localized population collapses of SLF were observed. Sampling is ongoing across similar locations to determine prevalence of these four entomopathogens, and if occurrences of SLF population disruption are associated (Clifton et al. 2021).

Figure #: Lateral image of male (A) and female (B) *Anastatus orientalis*. Photo credit: Joshua Milnes, WA State Dept Agriculture - Plant Protection Division.

Restoration and Recovery

Written by Fiona Smeaton, Samara Group

Once SLF has entered a region, complete eradication is unlikely. With great effort, infestations in the eastern United States have been successful only in limiting the spread and population size of SLF. Even with all precautions in place, it is likely that SLF will spread to Washington's urban and rural environments, though exactly when this will happen is unclear. Long-term management of SLF is dependent on a combination of strategies, the most effective of which are to reduce the preferred host plant TOH, continuously monitor the presence of SLF in order

to contain its spread, and apply the appropriate treatments as soon as possible (PennState Extension 2021).

The effects SLF may have on the environment will vary as it reaches new habitats due to the extensive list of known host plants; however, ecosystems with a diversity of native Pacific Northwest plants will be more resistant to SLF invasion than ecosystems already degraded by invasive plants. Restoration and recovery efforts should focus on maintaining and recuperating diverse native vegetation and protecting areas of high native biodiversity from ecosystem stressors.

Continuing management efforts to directly treat SLF, remove TOH, and deploy biocontrol measures will support recovery efforts and help to slow the spread of the invasion to other areas, but must be conducted carefully to protect other ecological resources. Following the specific timing and application strategy during SLF treatments is important for efforts to be successful–for example, the use of insecticides, especially neonicotinoids, can have damaging impacts to pollinators and other beneficial insects and should be used with extreme caution (Elmquist et al 2023). Environmental risks are also present with efforts to reduce TOH using manual and chemical removal. TOH herbicide treatments can have adverse impacts on wildlife if it enters non-target plants or waterways and TOH removal may result in temporary loss of habitat, especially along waterways, as loss of canopy cover can degrade water quality and have impacts on water temperature and flow (USDA APHIS 2021). Native plant species should be planted to replace TOH as soon as treatment of the area is finished and timelines allow in order to restore native biodiversity and ecosystem resilience. Additionally, replanting after TOH removal will make the mitigation process more appealing to private property owners and communities.

Education and Outreach

Outreach Plan

Written by Cassie Cichorz, WSDA & Allison Halpern, WSCC & Maria Marlin, WISC & Karla Salp, WSDA

Communication and Outreach Goals

Through public outreach and education, the Washington Invasive Species Council (WISC), Washington State Department of Agriculture (WSDA), and other entities will communicate the severe threat that SLF poses to Washington's agriculture and natural resources. The need for the public to be aware and report any suspected sightings will be reinforced. If the invasive insect is detected in the state, the participating entities will continue to provide updates on management and eradication efforts.

Communication efforts will focus on:

- Providing information about the threat that SLF poses to multiple agricultural industries throughout the state.
- Educating industry members and encouraging investment in employee training of SLF identification and reporting.
- Alerting high-risk points along the introduction pathway (ports, railroads) and promoting frequent and thorough inspection of shipping containers and goods.
- Ensuring the public is aware of SLF and its preferred host, TOH, as well as how to identify and report it.
- Explaining why early detection and rapid response is necessary.
- Developing educational resources and outreach materials for widespread distribution and use.
- Promoting cooperation and open communication between leading state agencies and stakeholders.
- Harmonizing our messaging across all partners and organizations.
- Finding and collaborating with project supporters, such as state and federal agencies, tribal leadership, city councils, county commissioners, environmental groups, and recreational organizations.
- Responding to misleading or inaccurate information.

- If SLF is detected, agencies will continue to use outreach and education to detect the extent of SLF, prevent the spread, monitor for new populations, and participate in the work needed to remove SLF from Washington state.

- Efforts will focus on encouraging support for eradication as a multi-pronged, multi-year eradication if detected. These efforts are detailed above in the eradication section, but may include

    - Support for SLF trapping or removal

    - Support for SLF treatment

    - Support for Quarantine

Audiences

- Tribes
- Ports/marinas
- Railroads
- Department of Transportation rest stops and ferry terminals
- Moving companies
- Industry: hops, grapes, Christmas trees, fruit trees, hemp
- Farmers
- Nurseries
- Master gardeners
- Private and public landowners
- Landscapers, outdoor workers

- Environmental groups/natural resource organizations
- State and local elected officials
- City/County/State parks and recreation
- County noxious weed boards
- Schools/Summer camps
- Conservation districts
- Hikers/outdoor enthusiasts
- Travelers within the pathway

Primary messages before the spotted lanternfly is detected in Washington

SLF poses a serious threat to Washington's natural resources and agriculture.

Public reporting of this invasive pest is critical to rapid response. The window to eradicate this pest will be extremely small; early detection is therefore crucial. If you see this insect, take a picture. A high-quality photo is necessary for verification. Then immediately report the sighting, with the photo attached, via one of the following options:

- Email **PestProgram@agr.wa.gov**
- On your phone or tablet using the **WA Invasives app**
- **Online** at **https://invasivespecies.wa.gov/**
- Call **800-443-6684** to reach the Washington State Department of Agriculture's Pest Hotline

If you can, save and preserve the specimen. WSDA may ask for it to verify the identification. To preserve a specimen, you may bag and freeze it. Alternatively, place in vial with ethanol (preferred) or isopropyl alcohol. Be sure to also note the date, collector name, and GPS coordinates if possible.

The public can also take an active role in helping to reduce the insect's preferred host, TOH. To better inform management decisions as well as prioritize removal, we need data on the distribution of TOH in Washington. The public can help this effort by surveying their communities for TOH and reporting the findings through the WA Invasives app.

If a TOH is growing on your property, it should be promptly removed. Everyone needs to do their part to reduce suitable habitat and food sources for the SLF. Contact your local noxious weed control board for more information on the best ways to remove this invasive weed.

Primary messages after SLF detected in Washington

The highly invasive spotted lanternfly has been detected in Washington. Take a photo and report suspected sightings immediately to the Washington State Department of Agriculture.

After reporting, kill the insect but preserve using the instructions above in case it is needed by state entomologists.

Secondary messages after SLF detected in Washington

If you are removing TOH, contact the local county noxious weed board for resources.

Eradication efforts are underway to protect our environment and farms from SLF. Here is what you can expect and how to learn more. (Description of physical and chemical methods will be described. Safety discussions will complement any mention of chemical applications.)

Strategy

- Conduct extensive public education and engagement to identify and report SLF sightings.
- Hold continual learning opportunities, both in person and virtual, to extend our reach throughout the state.
- Create graphic-heavy materials that are easy to understand, especially for non-English speakers. The term 'spotted lanternfly' will be translated into Spanish, but the English common name will also be used.
- Raise awareness through targeted social media posts and campaigns.
- Attend industry-wide conferences and conventions to interact with different growers, providing both educational opportunities and material they can use to teach others.
- Ensure local and state parks are updated and equipped with educational material to share with visitors.
- Dispense frequent and transparent communication about the SLF Washington State Action Plan.
- If SLF is detected in Washington, keep key stakeholders updated on the response and control efforts.
- Coordinate messaging internally and externally among staff and stakeholders.
- Inform cooperators/collaborators on how to help deliver information.
- Produce non-electronic forms of communication for cooperators/collaborators to help deliver public information.
- Promptly and professionally reply to concerns from the public or stakeholders.
- Work closely with USDA Animal and Plant Health Inspection Service (APHIS) on timing and messaging.

Communication Methods

- Workshops
- Conferences
- Webinars
- Website pages
- Blog entries
- Internet advertising
- Social media posts and reels

- News releases
- Handouts
- Identification tools and outreach handouts
- Billboards
- Radio Ads
- Public Service Announcements
- Videos
- E-mail distribution list
- E-mail listserv
- Public presentations

Spokespeople for Spotted Lanternfly and Tree-of-Heaven

To-Be-Determined (SLF & TOH), Executive Coordinator, Washington Invasive Species Council
Jessica La Belle (SLF & TOH), Invasive Species Program Specialist and Spotted Lanternfly Preparedness Advisory Group Coordinator, Washington Invasive Species Council
Maria Marlin (SLF & TOH), Community Outreach and Environmental Education Specialist, Washington Invasive Species Council
Sven-Erik Spichiger (SLF), Managing Entomologist, Washington State Department of Agriculture
Joshua Milnes (SLF), Entomologist, Washington State Department of Agriculture
Karla Salp (SLF), Public Engagement Specialist, Washington State Department of Agriculture
Cassie Cichorz (SLF), Public Education and Outreach Specialist, Washington State Department of Agriculture
Alison Halpern (SLF), Scientific Policy Advisor, Washington State Conservation Commission
Wendy Descamp (TOH), Pest Program Specialist, Washington State Department of Agriculture
Anne Schuster (TOH), Education Specialist, Washington State Noxious Weed Control Board

Key Stakeholders

- Washington Invasive Species Council
- Washington State Department of Agriculture
- Washington State Noxious Weed Board
- County weed boards
- State Conservation Commission
- Legislature
- USDA APHIS
- Washington Department of Transportation
- Tribes
- Railroads
- Ports

Industry Events (Outreach Opportunities)

- Washington Hop Growers Annual Meeting (January)
- Spokane Ag Expo (February)
- Wine VIT (February)
- Northwest Garden and Flower Show (February)
- National Grape Cooperative VIT (March)
- Master Gardeners Annual Trainings (October)
- Washington State Grape Society Annual Meeting (October)
- Washington State Tree Fruit Association (early December)
- North West Horticultural Exposition (December)
- Pacific Northwest Vegetable Association Conference and Trade Show (Mid-November)
- Washington Vegetation Management Association Weed Conference (November)
- Washington Small Fruit Conference (usually in November)
- Washington Farm Bureau Annual Meeting (November)
- Washington Association of Counties Annual Meeting (November)

Possible Challenges

- Areas may be urban with multicultural populations and require multiple translations and additional culturally specific context.
- Areas may be more rural and dotted with small towns; its landscape is covered with agriculture. The need for communication will need to be appropriate for neighborhoods and distant neighbors.
- The area may have a high population of monolingual non-English speakers.
- The area may have limited access to internet services or mobile devices.
- The area may have a high population of retirees and seniors who may need different methods of outreach and reporting.
- Growers may be harder to reach and prepare for success if they are out in the field farming.
- Finding appropriate cooperators/collaborators to help share the information.
- Presenting high level information or legal language in a less complex format.

Additional Activities

ACTIVITY	TIMING	ACTIONS/MESSAGING
Tree Check Month	August	This coincides with the adult stage of the SLF life cycle. Check trees for invasive insects such as the SLF.
Reassessment of key messages, talking points, and outreach material	January	Annual review of communication messaging based on SLF distribution and presence/absence in Washington.

Invasive Species Awareness Week	February	Public awareness is key to early detection and rapid response. An update on the SLF, including current national distribution, will be presented.
Spring Home & Garden Shows	January - April	Informational Booths and Presentations
Spring Plant Sales	March - May	Informational Booths and Handouts
State and County Fairs	August - September	Informational Booths and Presentations
RV & Camping Shows	Varies based on location	Informational Booth and Handouts
Sportsman Shows	Varies based on location	Informational Booth and Handouts

Outreach and Education: Conservation Districts, WSU County Extension Offices, Private Landowners and Producers

Written by Alison Halpern, WSCC & Todd Murray, WSU

Summary

The Washington State Conservation Commission (SCC) and Washington State University will help the Washington State Invasive Species Council and the Washington State Department of Agriculture to communicate key messages regarding the spotted lanternfly, an invasive species, to its audiences using a combination of print and digital media.

Target Audiences

- Conservation Districts (45 across WA)
- County and Tribal Offices (40 statewide)
- Washington Association of Conservation Districts (WACD)
- Private landowners / agricultural producers / community members
- General public and stakeholders
- WSU Extension Tribal Invasive Species Outreach Programs
- WSU Master Gardeners

- WSU Master Naturalists
- WSU Small Forest Landowners
- WSU Tree Fruit Extension
- WSU Viticulture and Enology Department
- WSU Pesticide Education and License Recertification

Strategy

SCC will help to develop and disburse educational content on the spotted lanternfly, including educational copy and graphics. Additionally, SCC will distribute this content in editable formats to conservation district employees, who will be encouraged to share this information with their digital audiences. SCC will also share digital materials directly to stakeholders through SCC social media and distribute printed materials when tabling events.

WSU Extension will package educational materials developed and translate resources to relevant extension communities. WSU Extension is ideal for educational outreach and distribution, and has a statewide network of over 7,000 volunteers, highly engaged natural resource professionals, and access to all pest management professionals.

Tactics

- Digital Media – Blog posts, social media posts, and newsletters.
- Print Media – Flyers and handouts for outreach events, and informational brochures for private landowners, agricultural producers, and community members.
- Collaborations – SCC will work with the Communications, Partnership, and Outreach (CPO) group, Better Ground, and the Education and Outreach Work Group to disseminate information on the spotted lanternfly to a broader audience.
- Integration of SLF into curricula used in educating WSU Extension volunteer networks, grower groups, and pest management professionals.

References

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