WASHINGTON STATE SPOTTED LANTERNFLY ACTION PLAN

2023

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Purpose Statement

Written by Fiona Smeaton, Samara Group

In Washington, the spotted lanternfly (SLF) will have devastating impacts on the local economy and environment. Due to the climate and landscape of Washington state, it is an incredibly fertile land and a major producer of agricultural crops as well as home to rich biodiverse natural areas. SLF is an invasive species, introduced in the Eastern United States in 2014 and has since spread to 13 states, as of 2023. It is closely associated with its preferred host, Tree-of-Heaven (TOH), an invasive tree that has established populations throughout the country. SLF is a plant hopper and highly effective hitchhiker. It is adept at using human transport as a way to establish outside of its physical flight range. In addition to adult and nymph hitchhiking, SLF will lay their eggs and effectively camouflage them as a smear of mud on almost any outdoor surface including wood, metal, and rock. These egg masses can be unknowingly transported across state lines and the nymphs will emerge and feed on any available host plants. SLF has been known to have more than 170 species of host plants and may utilize more as it moves into new habitats.

SLF is a threat to Washington's most profitable and highest produced crops including grapes, apples, and hops as well as many other medium or small farm crops. Infestations and excessive feeding on these known host plants can greatly weaken plants defenses and their ability to photosynthesize leading to low crop yields. There will be additional impacts from SLF beyond agriculture, they will feed on street trees and forest trees causing stressed and weakened plant communities in cities and natural areas.

The purpose of this plan is to outline Washington state's readiness and response actions to a SLF invasion. Before SLF inevitably arrives in Washington, the highest priority will be on preventative measures. This will include securing preparedness funding to support actions such as surveying and providing outreach and education to local governments, industries, and the public. Once SLF is definitively detected in Washington priorities will shift to response and management. This State Action Plan provides important background information on SLF and the impacts it would have in Washington. Following this the plan outlines readiness (pre-incident) actions before explaining response strategy and structure. The plan then details recommended management strategies to contain SLF. Finally, there is a detailed outreach and education plan describing priorities for informing Washingtonians about this serious threat and actions they can take to help stop SLF.

The development of this plan was a collaborative effort by the Washington State Spotted Lanternfly Preparedness Advisory Group (PAG) with members from agencies and organizations across Washington contributing writing sections and expert feedback. Members of the PAG met bi-monthly from November 2022 through July 2023 to discuss current research, best management practices and strategies, state response efforts, and other topics to be added to this plan.

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, Washington Invasive Species Council & 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

Figure 1. Adult spotted lanternflies are most commonly seen resting, with their wings folded.

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.

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

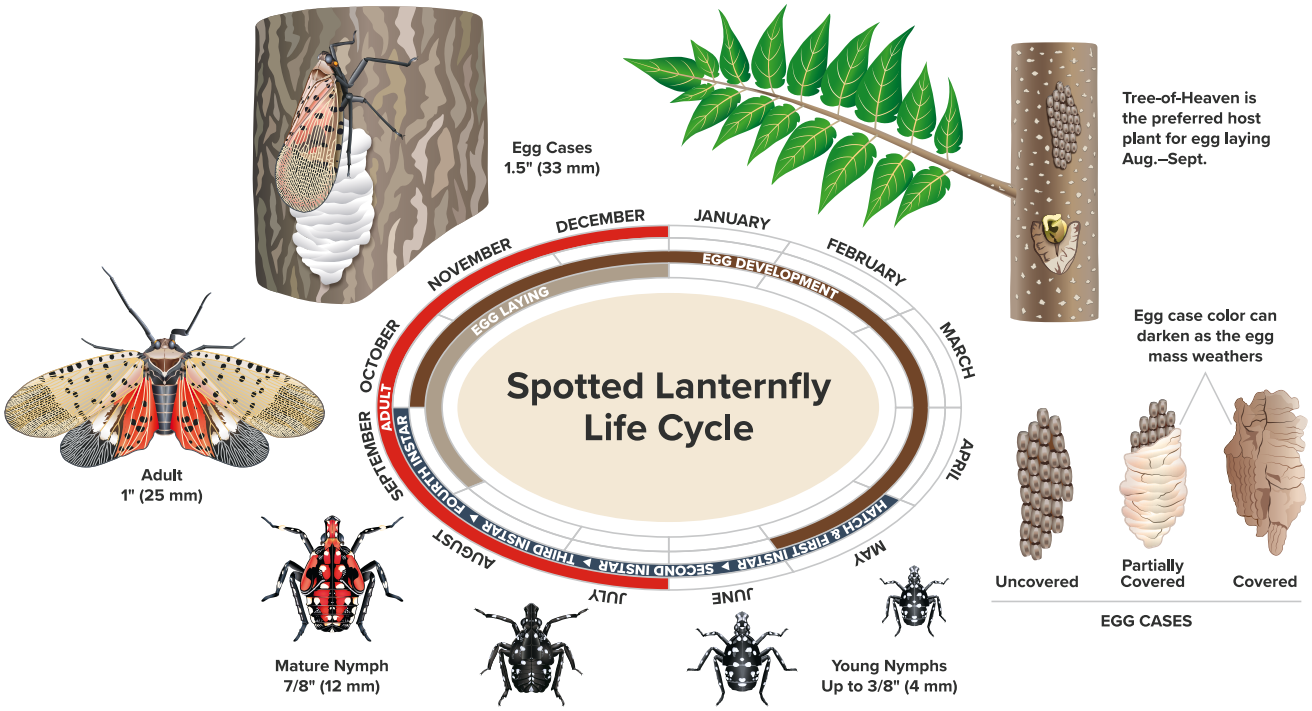


Figure 2. Spotted lanternfly life cycle (Washington State University Extension & Washington State Department of Agriculture).

wind or other obstacles, they will seek out a new tree and continue to climb up (Francese et al. 2020). Newly hatched nymphs are white for the first few hours after their emergence before their color darkens. 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.

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.

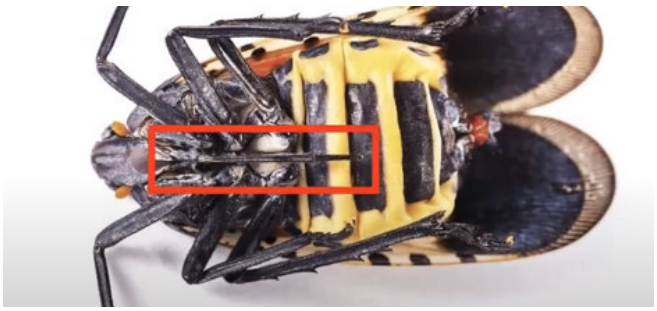


Figure 3. Spotted lanternfly with the piercing-sucking proboscis outlined (Photo by Julie Urban).

Figure 4. Egg masses are about an inch long and contain 30-50 eggs. Female spotted lanternfly will cover individual egg masses with wax to look like mud.

Host Plants

Written by Stacy Horton, Northwest Power and Conservation Council

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). A 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 5. Spotted lanternflies swarm a Tree-of-Heaven.

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 Weed 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 horseradish though none are a preferred food source (Cornell CALS) (UMBC 2021).

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. 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, on hops, 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 SLF, 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. 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).

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).

Photo credit: Washington State Wine Commission

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).

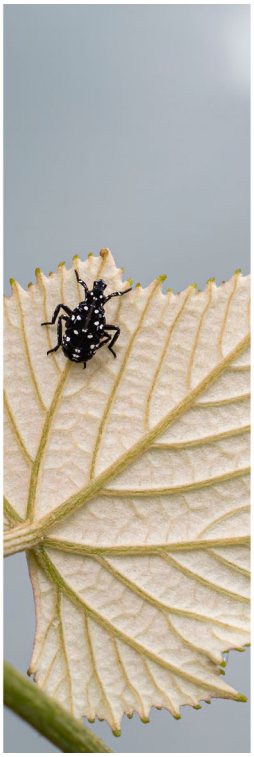
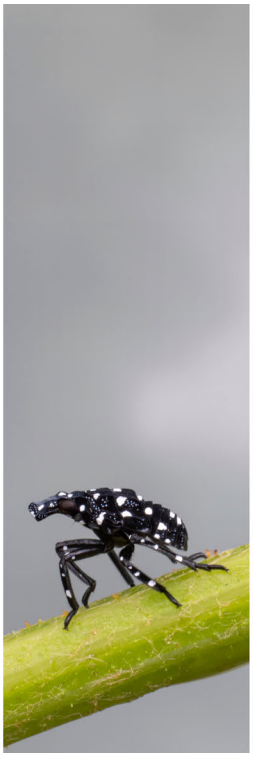
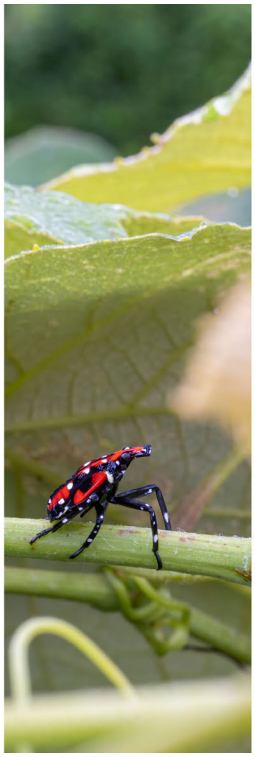
SLF nymphs feed on a wide range of plant species, while adults prefer to feed and lay eggs on TOH (USDA 2019). Nymphs have an especially large host range that includes annual and perennial flowers, herbaceous plants and any new and tender plant growth, whereas adults seem to depend more on certain hosts, 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). If SLF is able to feed on TOH, many more eggs are laid, and the egg laying begins sooner (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 (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

Written by Josh Milnes, Washington State Department of Agriculture & Sven-Erik Spichiger, Washington State Department of Agriculture

Spotted Lanternfly Pest History in United States

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 a 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

TOH 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 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 railway corridors. Adult SLF have been known to hitchhike on railcars across state lines. Furthermore, railcars that remain stagnant near TOH populations are often targeted by SLF that will

lay their egg masses on the railcars, allowing them to be transported and hatch in new locations. 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.

Hitchhiking Adults

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.

SLF 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 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.

Traveling Egg Masses

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.

Figure 6. Spotted lanternflies are highly effective hitchhikers.

IMPACTS OF A SPOTTED LANTERNFLY INVASION

Economic Risk

Written by Todd Murray, Washington State University

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 depending 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.

Photo credit: Washington State Wine Commission

Economic Impact to Washington State Wine and Grape Industry

Written by Melissa Hansen, Washington State Wine Commission and Todd Murray, Washington State University

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, Washington State Wine Commission and Todd Murray, Washington State University

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. Washington State is also a major producer of stone crops including apricots and peaches. In 2021 Washington produced over 3,500 tons of apricots valued at $866 price per ton and over 7,600 tons of peaches valued at $816 price per ton (USDA 2022). While smaller producers, Washington does also produce nectarines, prunes, and plums.

SLF infestations in tree fruit producing regions would have a significant impact on the cost and ability to export fruit. The insect is known to target fruit trees as host plants and cause damage and stress by feeding on tree sap and weakening its immune system. Long term infestations can significantly reduce crop production.

Economic Impact to Washington Hops Industry

Written by Melissa Hansen, Washington State Wine Commission and Todd Murray, Washington State University

Washington state is a major producer of hops, the green, cone-shaped flowers that give bitterness, flavor, and aromas to craft beers. The Pacific Northwest is the largest growing region of hops in the world; Washington represents about 70 percent of the PNW production. Additionally, 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 (NASS 2022).

The full scale impact that SLF will have on the Washington hops industry is unknown. SLF has proven to utilize hop vines as a host plant and it has appeared on the plant in every life stage (Urban & Leach 2023). Sooty mold that can occur after SLF feeding will impair hops ability to photosynthesize and thrive. The full extent of damage to the hops will depend on the severity of the infestations and management strategies applied.

Environmental Risk

Written by Fiona Smeaton, Samara Group

The impacts of a 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 will be 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.

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.

The treatments applied to SLF and TOH will have impacts on the environment as well. It is likely that a combination of manual/mechanical, chemical and biological management strategies will be the best response to combat SLF once it inevitably arrives in Washington. Pesticide drift and runoff can cause chemicals to enter waterways and non-targets which may in turn lead to environmental risk, especially to threatened and endangered species. 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 adult SLF are present and should not be performed in drought conditions. On the other hand, mist blowers (not likely to be used in combating SLF), spray treatments, or soil drenches are more likely to have pesticide drift, causing impacts to non-target species 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.

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.

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, Washington State University & Fiona Smeaton, Samara Group

Urban and community impacts from SLF will depend directly on the response by regulatory agencies. Eradication programs can be costly especially when host plant material is removed from a delimited range of the infestation. Urban and community impacts will be high given the large host range of SLF and the amount of host plant material that will need to be removed within a treatment area. The loss of canopy cover from removed street trees will have many detrimental effects on already overburdened communities. Historically underserved neighborhoods will see disproportionate financial impacts as residents may find themselves responsible for treating street trees near their property. Street trees are incredibly important and 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.

There will be long-term urban and community impacts associated with the management of established populations of SLF. Street trees will be especially susceptible to damage from SLF as they are already under many biotic and abiotic stressors due to living in an urban environment. Additionally, younger or newly planted trees that are not yet fully established are more likely to be killed from SLF damage. That is why there should be an emphasis on tree and shrub replacement with resistant varieties or non-host species. However, as SLF is so adaptable to new host species there will likely be additional costs and impacts incurred in urban areas from tree planting programs. In order to conserve plant health, there will need to be chemical control of established populations. This will help to mitigate the large inconvenience caused by honeydew deposition or aesthetic stress by large aggregations of feeding insects.

Early detection of SLF is dependent on industry and government employees, officials and members of the public being educated on how to identify and monitor for this pest (see the Survey and Detection Protocols section of this State Action Plan as well as the Outreach Plan).

In order to lessen the burden on municipalities and communities with limited resources it is important to use planning and outreach programs efficiently and effectively. Additionally, this will empower homeowners to take the right steps in monitoring for SLF and finding safe and effective treatments for SLF if it is found on their property.

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.

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. A SLF page with fact sheets and contacts will be available on the DOH website.

Cultural Impacts of Spotted Lanternfly

Written by Jessica La Belle, Washington Invasive Species Council

Spotted lanternfly (SLF) threatens a variety of natural and agricultural resources that can be assigned a discrete commercial or economic value, but there are other aspects of the natural world at risk not associated with a dollar amount that should be considered when responding to a plant health emergency.

Culturally significant ethnobotanicals are plants that are important parts of the historical and modern lives of members of tribal nations and Indigenous communities. These include First Foods, plants used in traditional medicines, ceremonies, or for cooking, as well as plants traditionally used to make shelters, bedding, clothing, dyes, baskets, tools, or weapons. They represent a rich cultural heritage that has been under threat in recent history, and many culturally significant ethnobotanicals may also be threatened by the introduction of invasive species.

Although culturally significant ethnobotanicals are highly valued by tribal nations and Indigenous communities, minimal if any attention has been given to them specifically in plant health emergency response efforts. This is largely because information on these species is challenging to find, and traditional knowledge keepers may not wish to disclose potentially sensitive cultural information. The potential sensitivity of this information is a direct result of federal policy, such as the 1883 Code of Indian Offenses, which prohibited and criminalized the performance of traditional ceremonies, religious practices, cultivation and use of traditional medicine, ingestion of traditional foods, and possession of culturally significant items. Punishments included the withholding of food for 10-30 days, and incarceration—in some cases, lifetime imprisonment. These laws were not formally addressed until the American Indian Religious Freedom Act and the Religious Freedom Restoration Act were passed in 1978 and 1993, respectively, which restored autonomy to the Tribes and civil rights to Indigenous people.

In an attempt to identify culturally significant ethnobotanicals at risk from SLF and also respect cultural sensitivities, cultural resource staff at the Washington State Recreation & Conservation Office and the Washington Department of Fish & Wildlife were consulted, and a literature review was conducted of those culturally significant ethnobotanicals previously identified in publication. The resulting list was cross-referenced with known host plants of SLF and is provided on the following page (Table 1).

This list is not exhaustive, and does not include plants that may still be of significant commercial interest to tribes. It may not include all culturally significant ethnobotanicals that SLF may prey upon, as SLF continues to find new host plants as it sweeps west across North America. For this reason, many plants in this list are identified by genus rather than individual species. Common names are provided but not all are listed as plants may be known by many different names, especially in different regions. For similar reasons, Sahaptin and Salishan language names are not included, but it should be noted that specific Indigenous language names should be considered and included when conducting outreach to specific tribal nations or Indigenous communities. Identifying the plants at risk by SLF that are of cultural significance to tribal nations and Indigenous communities is only the first step. Tribal nations should be engaged as co-managers and partners when possible, and notified when plant health emergency response efforts take place on tribally-owned land, and in areas that may be of cultural significance. Areas of cultural significance or of importance to Indigenous communities are not restricted to reservation lands or areas officially managed by tribes, and may not be clearly identified. In addition, knowledge keepers may be sensitive to disclosing this information for the reasons outlined above. The best way to navigate these challenges is to consult the Appendix: Washington State Tribal Contact List by County, which provides a list organized by county of tribes that should be contacted when activities are planned in the area. Rather than rely on previous contacts which may no longer be accurate or applicable, it is recommended to instead email and call the main office for each tribe and request direction to the appropriate individual in both the cultural and natural resources programs for the tribe.

Figure 7. Serviceberry (Amelanchier alnifolia). Photo Credit: Thayne Tuason (CC BY-SA 4.0, https://commons.wikimedia.org/w/index.php?curid=66100678).

Table 1. Culturally significant ethnobotanicals previously identified in publication and cross-referenced with known host plants of SLF.

CULTURALLY SIGNIFICANT ETHNOBOTANICALS AT RISK FROM SLF	
SPECIES OR GENUS NAME	**COMMON NAME(S)**
Amelanchier sp.	Serviceberry
Betula sp.	Birch
Cornus sp.	Dogwoods
Corylus sp.	Hazelnut
Elaeagnus umbellata	Autumn olive, silverberry
Fagus grandifolia	American beech
Fraxinus sp.	Ash
Lonicera sp.	Honeysuckle
Malus sp.	Apple
Monarda sp.	Bee balm, bergamot
Nicotiana sp.	Tobacco
Pinus sp.	Pine
Populus sp.	Poplar
Prunus sp.	Apricot, cherry, peach, plum
Pyrus sp.	Pear
Quercus sp.	Oak
Rhus sp.	Sumac
Rosa sp.	Rose
Rubus sp.	Blackberry, raspberry
Salix sp.	Willow
Syringa sp.	Lilac
Thuja sp.	Cedars
Vaccinium sp.	Blueberries, cranberries
Viburnum sp.	Blackhaw

READINESS (PRE-INCIDENT ACTIONS)

Preventative Measures

Written by Molly Darr, Washington State University & Josh Milnes, Washington State Department of Agriculture & Todd Murray, Washington State University

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. 8, right). 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 8. Spotted lanternfly 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, US Department of Agriculture

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.

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.

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 is helpful for surveyors to become familiar with what they look like. Signs and symptoms of feeding damage can help to locate 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. Identifying symptoms of feeding damage may be useful in areas of low density.

Nymphs (Fig. 9) and adults (Fig. 10) 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.

Figure 9. Young (left) and mature (right) spotted lanternfly nymphs.

Figure 10. Adult spotted lanternfly about to take flight (top) and adults seen resting (bottom).

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. Surveying for egg masses after a rain or morning dew can be very helpful in identification. Tree bark changes color when wet while the egg masses do not and therefore stand out and are easier to spot (StopSLF Virtual Summit North Carolina Observation 2023).

Figure 11. Spotted lanternfly egg mass after a female has covered it in wax to look like a smear of mud.

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.

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.

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 (Fig. 12). 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. For more information on TOH identification, see the Tree-of-Heaven Control section under the Management chapter.

Figure 12. Tree-of-Heaven has alternate, compound leaves, and each leaflet has one or more glandular teeth along the lower margin.

Preparedness Funding

Written by Justin Bush, Washington Invasive Species Council & Greg Haubrich, Washington State Department of Agriculture

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:

- Survey and Inventory
- Tree-of-Heaven Mapping and Removal
- 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

Written by Erin Coyle, Washington State Department of Agriculture & Sven-Erik Spichiger, Washington State Department of Agriculture

Planning Assumptions

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

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.

When tribal land is involved with a confirmed infestation, the tribal council will be notified early in the response process. The level of involvement will depend on the scale of the infestation and the appropriate response measures required. Tribal authorities will be contacted, refer to the Appendix: Washington State Tribal Contact List by County for details, to identify the designated individuals in both the cultural and natural resources programs to act as a tribal liaison throughout the response and management process.

Response Authorities and Regulatory Policies

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. 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 USFS Eastern Region (Region 9). Therefore, USFS priorities do not allow 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 [spongy moth] gypsy moth. Management of the [spongy moth] 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, Washington State Department of Agriculture & Sven-Erik Spichiger, Washington State Department of Agriculture

Concept of Operations

Washington State Department of Agriculture (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 (link details in references).

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 Erin Coyle, Washington State Department of Agriculture & Sven-Erik Spichiger, Washington State Department of Agriculture

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, Washington Invasive Species Council & Greg Haubrich, Washington State Department of Agriculture

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 (WISC) 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, Washington State Department of Agriculture

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. Table 2 (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).

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.

Table 2. Spotted lanternfly treatment timing. Adapted from Table created by Leach et al. 2021.

MANAGEMENT/ TREATMENT OPTIONS	January	February	March	April	May	June	July	August	September	October	November	December
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 insecticide application(s) (adults) tree and soil injections							■	■	■			
Vacuuming (hatch until adult)				■	■	■	■	■	■	■	■	

**Soy bean oil (food grade)*

Tree-of-Heaven Control

Written by Anne Schuster, Washington Noxious Weed Control Board & Jennifer Mendoza, Washington State Noxious Weeds Coordinators Association

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 and many lateral roots, which can spread out 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.

Figure 13. Young Tree-of-Heaven growing through concrete (left). Loosely twisted, oblong samaras (center) are 3 to 5 cm long and have 1 centrally placed seed. Tree-of-Heaven bark (right, photo credit: Jennifer Mendoza).

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 to 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, Washington State University

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, mainly TOH, 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. 14) 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).

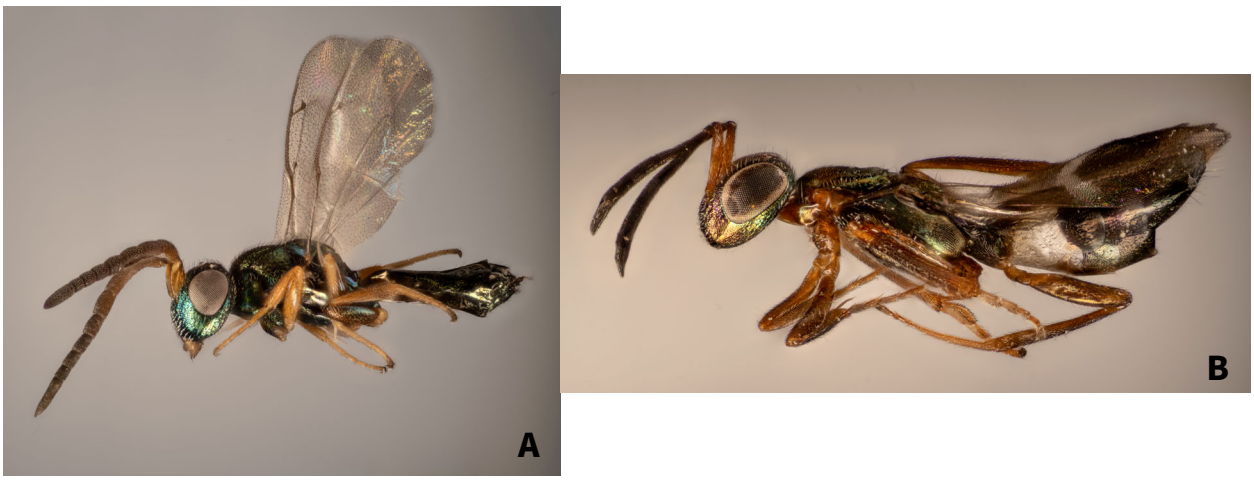


Figure 14. Lateral image of male (A) and female (B) Anastatus orientalis. Photo credit: Joshua Milnes, WA State Dept. Agriculture - Plant Protection Division.

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* (Figure 15) is already marketed as a commercialized biopesticide and would be a relatively simple addition to a 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 15. Spotted lanternfly infected with Beauveria bassiana fungus. Photo credit: David Anstiss (https://creativecommons.org/licenses/by-sa/4.0).

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). Since SLF are such effective hitchhikers it is important to monitor and respond quickly to continuous pathways such as rail lines and roadways where TOH is frequent. Additionally, removal of those TOH will have a significant impact in limiting the spread of SLF.

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 a 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, Washington State Department of Agriculture & Toyo Garber, Washington State Conservation Commission & Maria Marlin, Washington Invasive Species Council & Karla Salp, Washington State Department of Agriculture

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 suspected sightings will be reinforced. If SLF 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 Response and Management Chapters, but may include support for SLF trapping or removal, support for SLF treatment, and/or support for quarantine.

COMMUNICATION AUDIENCES

Includes individuals or organizations that will likely encounter SLF once it reaches Washington and should remain informed of its status.

- 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
- Irrigation districts and companies
- Hikers/outdoor enthusiasts
- Travelers within the pathway

COMMUNICATION STRATEGIES

In order to successfully communicate the threat posed by SLF to Washington state, outreach will need to utilize effective strategies for key stakeholders and impacted industries, organizations and members of the public.

- 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.

KEY STAKEHOLDERS

Key stakeholders represent agencies and organizations that will be most impacted by a SLF invasion and will either lead or support outreach efforts.

- 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

OUTREACH MESSAGING

Primary messages before SLF 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 it in a 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 is 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 is 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.)

COMMUNICATION METHODS

A variety of communication methods will ensure that the SLF outreach messages are heard by the most audiences. Key stakeholders and lead agencies should utilize these various outreach methods both prior to SLF arrival in Washington state and after it is established.

- 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

INDUSTRY EVENTS

Below is a list of specific events that will provide the best outreach opportunities for Washington state. These industries will likely encounter SLF directly and will also see the most damaging impacts from an invasion.

EVENT	TIMING
Washington Hop Growers Annual Meeting	January
Spokane Ag Expo	February
WineVit	February
Northwest Garden and Flower Show	February
National Grape Cooperative VIT	March
Master Gardeners Annual Trainings	October
Washington State Grape Society Annual Meeting	November
Washington Vegetation Management Association Weed Conference	November*
Washington Small Fruit Conference	November
Washington Farm Bureau Annual Meeting	November
Washington Association of Counties Annual Meeting	November
Pacific Northwest Vegetable Association Conference and Trade Show	Mid-November
Washington State Tree Fruit Association	Early December
North West Horticultural Exposition	December
Washington State Water Resources Association	December

**Usually*

ADDITIONAL ACTIVITIES

ACTIVITY / EVENT	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

SPOKESPEOPLE FOR SPOTTED LANTERNFLY (SLF) AND TREE-OF-HEAVEN (TOH)

The following individuals represent the spokespeople for SLF and TOH in Washington state and can be contacted to provide materials and resources for outreach efforts.

NAME, TITLE	TOPIC	AFFILIATION
Stephanie Helms, Executive Coordinator	SLF & TOH	Washington Invasive Species Council
Jessica La Belle, Invasive Species Program Specialist and Spotted Lanternfly Preparedness Advisory Group Coordinator	SLF & TOH	Washington Invasive Species Council
Maria Marlin, Community Outreach and Environmental Education Specialist	SLF & TOH	Washington Invasive Species Council
Sven-Erik Spichiger, Acting Pest Program Manager & Acting State Plant Regulatory Official and Managing Entomologist	SLF	Washington State Department of Agriculture
Joshua Milnes, Entomologist	SLF	Washington State Department of Agriculture
Karla Salp, Public Engagement Specialist	SLF	Washington State Department of Agriculture
Cassie Cichorz, Public Education and Outreach Specialist	SLF	Washington State Department of Agriculture
Alison Halpern, Scientific Policy Advisor	SLF	Washington State Conservation Commission
Wendy Descamp, Pest Program Specialist	TOH	Washington State Department of Agriculture
Anne Schuster, Education Specialist	TOH	Washington State Noxious Weed Control Board

ADDITIONAL OUTREACH CONSIDERATIONS

While performing outreach efforts there are certain challenges and considerations that may arise. Acknowledging and addressing these considerations prior to outreach will help to ensure key messages successfully reach various communications audiences.

- 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.

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

Written by Alison Halpern, Washington State Conservation Commission & Todd Murray, Washington State University

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

SCC will help to develop and disburse educational content on SLF, including 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.

COMMUNICATION AUDIENCES

The following list includes priority audiences for SCC and WSU outreach and education efforts around SLF introduction to Washington state and TOH control.

- 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

COMMUNICATION METHODS

The following communication methods will be utilized by SCC and WSU in order to reach the most audiences likely to be impacted by SLF within each existing network.

- 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.

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Appendix:
Washington State Tribal Contact List by County

Adams:

- Confederated Tribes and Bands of the Yakama Nation
- Confederated Tribes of the Colville Reservation
- Spokane Tribe of Indians

Asotin:

- Confederated Tribes and Bands of the Yakama Nation
- Confederated Tribes of the Colville Reservation
- Confederated Tribes of the Umatilla Indian Reservation
- Nez Perce Tribe

Benton:

- Confederated Tribes and Bands of the Yakama Nation
- Confederated Tribes of the Colville Reservation
- Confederated Tribes of the Umatilla Indian Reservation

Chelan:

- Confederated Tribes and Bands of the Yakama Nation
- Confederated Tribes of the Colville Reservation
- Kalispel Tribe
- Sauk-Suiattle Indian Tribe
- Upper Skagit Tribe

Clallam:

- Confederated Tribes and Bands of the Yakama Nation
- Hoh Tribe
- Jamestown S'Klallam Tribe
- Lower Elwha Klallam Tribe
- Makah Tribe
- Port Gamble S'Klallam Tribe
- Quileute Nation

Clark:

- Confederated Tribes and Bands of the Yakama Nation
- The Confederated Tribes of the Chehalis Reservation
- Confederated Tribes of Grand Ronde Community of Oregon
- Confederated Tribes of Warm Springs
- Cowlitz Indian Tribe
- Chinook Indian Nation

Columbia:

- Confederated Tribes and Bands of the Yakama Nation
- Confederated Tribes of the Colville Reservation
- Confederated Tribes of the Umatilla Indian Reservation
- Nez Perce Tribe

Cowlitz:

- Confederated Tribes and Bands of the Yakama Nation
- The Confederated Tribes of the Chehalis Reservation
- Confederated Tribes of Grand Ronde Community of Oregon
- Confederated Tribes of Warm Springs
- Cowlitz Indian Tribe
- Chinook Indian Nation
- Squaxin Island Tribe

Douglas:

- Confederated Tribes and Bands of the Yakama Nation
- Confederated Tribes of the Colville Reservation
- Kalispel Tribe

Ferry:

- Confederated Tribes and Bands of the Yakama Nation
- Confederated Tribes of the Colville Reservation
- Kalispel Tribe
- Spokane Tribe of Indians

Franklin:

- Confederated Tribes and Bands of the Yakama Nation
- Confederated Tribes of the Colville Reservation
- Confederated Tribes of the Umatilla Indian Reservation
- Nez Perce Tribe

Garfield:

- Confederated Tribes and Bands of the Yakama Nation
- Confederated Tribes of the Colville Reservation
- Confederated Tribes of the Umatilla Indian Reservation
- Nez Perce Tribe

Grant:

- Confederated Tribes and Bands of the Yakama Nation
- Confederated Tribes of the Colville Reservation
- Wanapum Tribe

Grays Harbor:

- Confederated Tribes and Bands of the Yakama Nation
- The Confederated Tribes of the Chehalis Reservation
- Squaxin Island Tribe
- Hoh Tribe
- Quileute Nation
- Quinault Indian Nation
- Shoalwater Bay Tribe
- Skokomish Indian Tribe

Island:

- Confederated Tribes and Bands of the Yakama Nation
- Jamestown S'Klallam Tribe
- Upper Skagit Tribe
- Nooksack Tribe
- Samish Indian Nation
- Snoqualmie Indian Tribe
- Stillaguamish Tribe of Indians
- Swinomish Indian Tribal Community
- Tulalip Tribes

Jefferson:

- Confederated Tribes and Bands of the Yakama Nation
- Jamestown S'Klallam Tribe
- Hoh Tribe
- Quileute Nation
- Quinault Indian Nation
- Skokomish Indian Tribe
- Lower Elwha Klallam Tribe
- Port Gamble S'Klallam Tribe
- Suquamish Tribe

King:

- Confederated Tribes and Bands of the Yakama Nation
- Jamestown S'Klallam Tribe
- Suquamish Tribe
- Snoqualmie Indian Tribe
- Stillaguamish Tribe of Indians
- Tulalip Tribes

King (continued):

- Squaxin Island Tribe
- Sauk-Suiattle Indian Tribe
- Muckleshoot Tribe
- Puyallup Tribe of Indians
- Duwamish Tribe

Kitsap:

- Confederated Tribes and Bands of the Yakama Nation
- Suquamish Tribe
- Tulalip Tribes
- Puyallup Tribe of Indians
- Skokomish Indian Tribe
- Port Gamble S'Klallam Tribe

Kittitas:

- Confederated Tribes and Bands of the Yakama Nation
- Snoqualmie Indian Tribe
- Sauk-Suiattle Indian Tribe
- Confederated Tribes of the Colville Reservation
- Wanapum Tribe

Klickitat:

- Confederated Tribes and Bands of the Yakama Nation
- Confederated Tribes of the Umatilla Indian Reservation
- Confederated Tribes of Warm Springs

Lewis:

- Confederated Tribes and Bands of the Yakama Nation
- Squaxin Island Tribe
- Quinault Indian Nation
- The Confederated Tribes of the Chehalis Reservation
- Shoalwater Bay Tribe
- Confederated Tribes of Grand Ronde Community of Oregon
- Cowlitz Indian Tribe
- Nisqually Tribe

Lincoln:

- Confederated Tribes and Bands of the Yakama Nation
- Confederated Tribes of the Colville Reservation
- Spokane Tribe of Indians

Mason:

- Confederated Tribes and Bands of the Yakama Nation
- Squaxin Island Tribe
- Quinault Indian Nation
- The Confederated Tribes of the Chehalis Reservation
- Suquamish Tribe
- Skokomish Indian Tribe
- Port Gamble S'Klallam Tribe
- Jamestown S'Klallam Tribe

Okanogan:

- Confederated Tribes and Bands of the Yakama Nation
- Confederated Tribes of the Colville Reservation
- Upper Skagit Tribe

Pacific:

- Confederated Tribes and Bands of the Yakama Nation
- Quinault Indian Nation
- The Confederated Tribes of the Chehalis Reservation
- Shoalwater Bay Tribe
- Confederated Tribes of Grand Ronde Community of Oregon
- Confederated Tribes of Warm Springs
- Chinook Indian Nation

Pend Oreille:

- Confederated Tribes and Bands of the Yakama Nation
- Spokane Tribe of Indians
- Nez Perce Tribe
- Kalispel Tribe

Pierce:

- Confederated Tribes and Bands of the Yakama Nation
- Squaxin Island Tribe
- Suquamish Tribe
- Nisqually Tribe
- Snoqualmie Indian Tribe
- Puyallup Tribe of Indians
- Muckleshoot Tribe
- KiKiallus Nation
- Steilacoom Indian Tribe

San Juan:

- Confederated Tribes and Bands of the Yakama Nation
- Port Gamble S'Klallam Tribe
- Jamestown S'Klallam Tribe
- Stillaguamish Tribe of Indians
- Nooksack Tribe
- Samish Indian Nation
- Swinomish Indian Tribal Community
- Lummi Nation

Skagit:

- Confederated Tribes and Bands of the Yakama Nation
- Stillaguamish Tribe of Indians
- Nooksack Tribe
- Samish Indian Nation
- Swinomish Indian Tribal Community
- Snoqualmie Indian Tribe
- Confederated Tribes of the Colville Reservation
- Upper Skagit Tribe
- Tulalip Tribes

Skamania:

- Confederated Tribes and Bands of the Yakama Nation
- The Confederated Tribes of the Chehalis Reservation
- Confederated Tribes of Warm Springs
- Cowlitz Indian Tribe

Snohomish:

- Confederated Tribes and Bands of the Yakama Nation
- Stillaguamish Tribe of Indians
- Nooksack Tribe
- Samish Indian Nation
- Swinomish Indian Tribal Community
- Snoqualmie Indian Tribe
- Upper Skagit Tribe
- Tulalip Tribes

Spokane:

- Confederated Tribes and Bands of the Yakama Nation
- Confederated Tribes of the Colville Reservation
- Spokane Tribe of Indians
- Nez Perce Tribe
- Coeur d'Alene Tribe

Stevens:

- Confederated Tribes and Bands of the Yakama Nation
- Confederated Tribes of the Colville Reservation
- Spokane Tribe of Indians
- Nez Perce Tribe
- Kalispel Tribe

Thurston:

- Confederated Tribes and Bands of the Yakama Nation
- The Confederated Tribes of the Chehalis Reservation
- Squaxin Island Tribe
- Nisqually Tribe
- Puyallup Tribe of Indians
- KiKiallus Nation
- Quinault Indian Nation

Wahkiakum:

- Confederated Tribes and Bands of the Yakama Nation
- The Confederated Tribes of the Chehalis Reservation
- Quinault Indian Nation
- Confederated Tribes of Warm Springs
- Cowlitz Indian Tribe
- Shoalwater Bay Tribe
- Confederated Tribes of Grand Ronde Community of Oregon
- Chinook Indian Nation

Walla Walla:

- Confederated Tribes and Bands of the Yakama Nation
- Confederated Tribes of the Colville Reservation
- Nez Perce Tribe
- Confederated Tribes of the Umatilla Indian Reservation

Whatcom:

- Confederated Tribes and Bands of the Yakama Nation
- Confederated Tribes of the Colville Reservation
- Stillaguamish Tribe of Indians
- Nooksack Tribe
- Samish Indian Nation
- Swinomish Indian Tribal Community
- Upper Skagit Tribe
- Lummi Nation
- Snoqualmoo Tribe of Indians

Whitman:

- Confederated Tribes and Bands of the Yakama Nation
- Confederated Tribes of the Colville Reservation
- Nez Perce Tribe
- Spokane Tribe of Indians
- Coeur d'Alene Tribe

Yakima:

- Confederated Tribes and Bands of the Yakama Nation