2017 Entomology Project Report -
Plant Protection Division, Pest Program
Washington State Department of Agriculture

2 May 2018

2017 Grape Survey Report

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Summary

The WSDA conducted a Grape Commodity Survey in 2017 to determine the status of invasive pests and diseases in Washington State affecting juice, wine and table grapes. Except for Grape Phylloxera, which is known to occur in Washington, no other target pests of this survey were found.

Background

Washington State is 2nd in the US in wine grape production with 55,445 acres currently in production (Mertz et al. 2017), which support over 900 wineries (washingtonwine.org). The impact of this wine industry on the state is estimated to be $4.8 billion (washingtonwine.org). Washington is also the largest producer of juice grapes (Honig et al. 2017) with 21,632 acres of primarily Concord and some Niagara varieties (Mertz et al. 2017).

The value of these crops could decrease substantially if certain invasive pests established here. Additional pesticide sprays would be required, which would disrupt Integrated Pest Management (IPM) programs already in place. All of these pests and diseases are also restricted by various countries, making exports of vine stock, nursery stock and fresh fruit more difficult.

Light Brown Apple Moth (*Epiphyas postvittana* (Walker))

Light brown apple moth (LBAM) is a highly polyphagous species with more than 1,000 plant species including over 250 fruits and vegetables such as apples, citrus, corn, peaches, berries, tomatoes and avocados (Weeks et al. 2012). Larvae feed on buds, flowers and leaves, with most damage occurring due to fruit scarring and rotting from fruit feeding (Gilligan & Epstein 2014). LBAM is native to Australia, and has been introduced to Hawaii, Tasmania, New Zealand, and parts of Europe. It was found in California in 2006, with eradication efforts still ongoing (Lewis & Hodges 2010). Forewing patterning, especially on males, is highly variable, and is frequently misidentified when male genitalia are not used as the main diagnostic characteristic (Gilligan & Epstein 2014).

European Grapevine Moth (*Lobesia botrana* (Denis & Schiffermuller))

European grapevine moth is the main grape pest in southern Europe (Stavridis & Savopoulou-Soltani 1998). Minor hosts in 27 different plant families include apple, sweet cherry, plum, peach, pear, roses, raspberry, and potato. Larval damage promotes numerous fungal rots, especially *Botrytis cinerea* (Sullivan & Breiter 2007). Though the likelihood of establishment in Washington is low, the risk of introduction is high. European grapevine moth was detected in Chile in 2008, and was discovered in California vineyards in 2009 where there are still quarantine restrictions, though it is considered eradicated there since August 2016 (Lucchi et al. 2014, USDA APHIS 2018).

European Grape Berry Moth (*Eupoecilia ambiguella* (Hubner))

The European grape berry moth causes similar damage and is native to the same areas as European grapevine moth. However, while the European grapevine moth may have three or more generations a year, the European grape berry moth only has two, with the second being the economically injurious one (Gilligan & Epstein 2014). It prefers cooler, moist climates (Frolov 2008) and could become established in western Washington, though it seems unlikely it would become a serious problem in arid eastern Washington.

Summer Fruit Tortrix (*Adoxophyes orana* Fischer von Rösslerstamm)

Summer fruit tortrix is a major leafroller pest of grapes, apples, pears and stone fruit in Europe and Asia, and feeds on more than 50 other plant species in other families (Gilligan & Epstein 2014). Direct larval feeding damage can be serious, and secondary fungal infections are common. As it prefers higher temperatures and high moisture, this insect is unlikely to establish in most of Washington, however, the potential economic and environmental damage if it were to establish is very high.

Grape Phylloxera (*Daktulosphaira vitifoliae* (Fitch 1855))

Grape Phylloxera is a native American grape pest that was once responsible for the almost complete destruction of the French wine industry (Riley 1874). Since then, nearly all major wine growing regions have used vines grafted on resistant American rootstock, with a few exceptions, including Washington State (Harbertson & Keller 2012). Grape Phylloxera are a microscopic aphid-like insect with a complicated life cycle (Riley 1874). The leaf form, which has not been found in Washington State, creates leaf galls that do not cause major issues with the plant. The root form, however, cause root galls and necrotic spots with

secondary fungal infections that cause stunting and death in European varieties of grapes (UC IPM 2018). Grape Phylloxera prefers clay soils, which most Washington wine grape growing regions lack. Due to this, while Grape Phylloxera may never become a major Washington pest, tracking its locations is still important in this area with a majority of self-rooted, non-resistant vines (Keller et al. 2012).

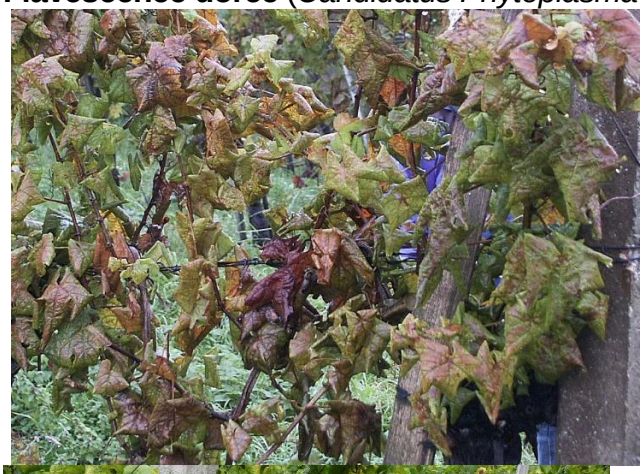
History of Grape Phylloxera in Washington State

The first record of Grape Phylloxera was in 1910 in Kennewick. The first confirmed record of Grape Phylloxera is from Vashon Island in 1943 (Haskett 1988). Following that, the WSDA began conducting nursey block inspections in 1987. After the program was expanded in 1988 to include areas outside of the nursery blocks, 8 locations tested positive, mainly around Wapato and the Tri-Cities areas (Haskett 1988). All nursery blocks again tested negative in 1988 and 1989 (Haskett 1989). Another WSDA survey was conducted in 2014, and 2 positive sites were found that year, one near Wapato, and one near Malaga in Chelan County (Klaus 2015).

Australian Grapevine Yellows (*Candidatus Phytoplasma australiense* 16SrXII-B)


Australian Grapevine Yellows (AGY) have been found in Australia, New Zealand, Israel, and Bolivia, and unlike the name suggests also infects papaya, periwinkles, chickpeas, pumpkins, cabbage trees, strawberries, alfalfa, peaches, red clover, beans and others (Sullivan & Breiter 2007). The causative agent is a mollicute, a type of prokaryote, which resides in the phloem tissue of infected plants. The Australian Grapevine Yellows are part of the aster yellows group phytoplasmas (Padovan et al. 1995). The only known vector of AGY is *Oliarus atkinsoni*, the cixiic planthopper, but some polyphagous psyllids, planthoppers and leafhoppers are also believed to be involved (Sullivan & Breiter 2007). Washington is considered to only be at moderate risk from this pathogen but with its broad range of hosts and trade restrictions there is cause for concern.

Flavescence dorée (*Candidatus Phytoplasma vitis* 16SrV-C)

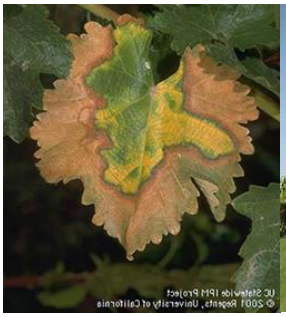
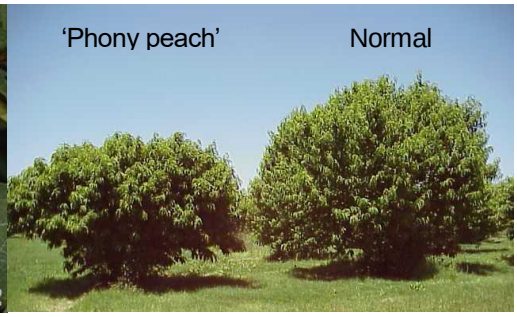


Flavescence doree phytoplasma is part of the elm yellows group (CABI 2017). It is currently only found in parts of Europe, although its leafhopper vector, *Scaphoideus titanus*, is now found throughout most of Europe and is native to North America. The presence of this vector is a threat, as any introduction of the pathogen may be efficiently spread from an infected source. As with many plant diseases, there is no cure, and control relies on prevention and vector control.

Rotbrenner, Red Fire Disease (*Pseudopezicula tracheiphila*)


Rotbrenner is a fungal disease producing scorch-like symptoms on grape leaves. It is related to the North American pathogen *P. tetraspora* (angular leaf scorch), which causes similar symptoms (NSW DPI 2013). Rotbrenner is currently found only in Europe, and is especially common in France and Germany. It overwinters in dead leaves, and its wind and water-borne spores require several days of rainfall or high humidity at 15-20°C for infection of new growth to occur (NSW DPI 2013).

Pierce's Disease, Bacterial Leaf Scorch (*Xylella fastidiosa*)

Xylella fastidiosa is a xylem dwelling bacteria with almost as many common names as hosts. The strain that infects grapes is known as Pierce's Disease, in plums it is Plum Leaf Scald, in peaches it is Phony Peach Disease, in citrus it is Citrus Variegated Chlorosis, and in trees including elm, oak, almond, coffee, and maple it is Leaf Scorch (Mizell et al. 2015). Over 30 families of plants, and 150 individual species are susceptible to *X. fastidiosa*. It is spread by xylem feeding leafhoppers, especially sharpshooters, and by grafting of infected material. It is widespread throughout southern Europe, the southeastern United States, and has been found in areas in California, Ontario, the Midwest and Mid-Atlantic States. It has recently become of great concern for the California wine industry with the introduction of the glassy-winged sharpshooter, an efficient and far-flying vector. There is no cure for *X. fastidiosa*, it kills in only a few years, and removal of infected trees is typically the only effective method of limiting its spread.

2017 Grape Survey Objective

- The pest free status of Washington State will be maintained by early detection and possible eradication of an economically important group of insect pests.
- Washington State's grape industries will be protected from an important group of destructive pest insects.
- The survey will help maintain the unregulated export of fruit from Washington State to international markets.

Materials and Methods

WSDA placed and monitored traps for four different species of moths, Grape Phylloxera, and four plant diseases (See **Table 1**), for the CAPS Grape Survey from June 21 through September 30. Twelve Washington State counties were trapped with sticky traps baited with pheromone lures (See **Table 2**) and fourteen counties had leaf samples taken for disease testing (See **Table 3**). Traps were checked every two to four weeks and changed at least every four weeks. Leaf samples were taken from grapes vines with yellowing, reddening, blotching, or scorching symptoms in order to test for the plant diseases. In general the methods for traps and leaf sampling as laid out in the Grape Commodity-based Survey Reference (Sullivan & Breiter 2007) were followed.

Trap deployment focused on commercial wine and juice grape, non-commercial, residential grape vines in populated areas, abandoned vineyards, and feral, roadside grape vines. All *Vitis* species were targeted.

In 2017, WSDA placed and monitored a total of 1,564 Grape CAPS trap sites statewide, as detailed in **Table 4** and the map on page 10. Leaves were collected from 1,197 novel grape sites (with a total 2,038 samples sites for a broader *Xylella fastidiosa* survey, plus 1,151 negative field observations), and tested for plant diseases (See **Table 5** and the maps on pages 11 and 12).

Table 1 – Target Pests and Diseases of 2017 CAPS

Common Name	Scientific Name	Abbreviation
Light Brown Apple Moth	*Epiphyas postvittana*	LBAM
European Grapevine Moth	*Lobesia botrana*	LOBBOT
European Grape Berry Moth	*Eupoecilia ambiguella*	EGBM
Summer Fruit Tortrix	*Adoxophyes orana*	ADOORA
Grape Phylloxera	*Daktulosphaira vitifoliae*	DAKVIT
Australian Grape Yellows	*Candidatus Phytoplasma australiense* 16SrXII-B	AGY
Flavescence dorée	*Candidatus Phytoplasma vitis* 16SrV-C	FD
Rotbrenner	*Pseudopezicula tracheiphila*	PSETRA
Pierce's Disease	*Xylella fastidiosa*	XYLLELA

Table 2 – Counties Trapped for EPOGS in 2017		
Benton	Grant	Skagit
Chelan	Kittitas	Walla Walla
Douglas	Klickitat	Whatcom
Franklin	Okanogan	Yakima

Table 3 - Counties Sampled for EPOGS in 2017		
Benton	Kittitas	Spokane
Chelan	Klickitat	Walla Walla
Douglas	Okanogan	Whatcom
Franklin	Skagit	Yakima
Grant	Skamania	

Table 4 - Trap Sites by County and Target 2017

Grape Commodity Trap Survey Targets					
County	**European Grapevine Moth**	**European Grape Berry Moth**	**Light Brown Apple Moth**	**Summer Fruit Tortrix Moth**	**County Totals**
Benton	126	99	98	97	**420**
Chelan	8	5	6	7	**26**
Douglas	2	2	3	2	**9**
Franklin	22	21	21	21	**85**
Grant	30	28	28	29	**115**
Kittitas	4	4	4	4	**16**
Klickitat	24	22	23	25	**94**
Okanogan	8	5	7	7	**27**
Skagit	41	41	43	41	**166**
Walla Walla	13	12	13	14	**52**
Whatcom	39	46	54	55	**194**
Yakima	129	74	78	79	**360**
Totals	**446**	**359**	**378**	**381**	**1564**

Table 5 - Sample Sites by County and Tested Target Species 2017

Grape Commodity Sample Survey Targets								
County	**AGY**	**FD**	**PSETRA**	**DAKVIT**	**XYLLELA**	**County Totals**	**Total Leaf Samples***	**Total Root Samples***
Benton	23	23	33	35	263	**377**	263	35
Chelan	21	21	47	14	194	**297**	187	16

Douglas	1	1	3	5	11	**21**	11	5
Franklin	36	36	76	8	300	**456**	300	8
Grant	6	6	13	8	88	**121**	88	8
Kittitas	0	0	0	0	1	**1**	1	0
Klickitat	0	0	2	0	5	**7**	5	0
Okanogan	1	1	0	4	3	**9**	4	3
Skagit	5	5	3	0	11	**24**	12	0
Skamania	0	0	0	1	0	**1**	0	1
Spokane	0	0	0	0	1	**1**	1	0
Walla Walla	0	0	3	6	13	**22**	13	6
Whatcom	4	4	12	4	20	**44**	21	4
Yakima	28	28	57	19	290	**422**	291	19
Totals	**125**	**125**	**249**	**104**	**1200**	**1803**	**1197**	**105**

*****Total leaf and root sample columns are representative of the actual number of samples taken. Some samples were tested for multiple survey targets.

Results

Light Brown Apple Moth, European Grapevine Moth, European Grape Berry Moth, and Summer Fruit Tortrix were not found.

Grape Phylloxera was found in one known site near Wapato, and not found in the known site near Wenatchee which had been treated. Microscopy detected another positive in a sample sent by a Skamania county grower after the survey had ended (the 105th sample), and PCR detected a further new positive also near Wapato (see map, page 11).

Pierce's Disease was not detected in grapes. However, extended testing for *Xylella fastidiosa* in other hosts for the nursery certification survey resulted in one positive in a willow tree (*Salix* sp.) in Grant County at Potholes State Park (see Xylella survey map, page 12). Intensive further sampling of that willow and surrounding vegetation was negative.

Summary of 2017 Survey

Pests surveyed (common names): Light brown apple moth, European grapevine moth, European grape berry moth, Summer fruit tortrix, Grape Phylloxera, Australian grapevine yellows, Flavescence dorée, Rotbrenner, Pierce's disease

Pests surveyed (scientific names): *Epiphyas postvittana*, *Lobesia botrana*, *Eupoecilia ambiguella*, *Adoxophyes orana*, *Daktulosphaira vitifoliae*, *Candidatus Phytoplasma australiense* 16SrXII-B, *Candidatus Phytoplasma vitis* 16SrV-C, *Pseudopezicula tracheiphila*, *Xylella fastidiosa*

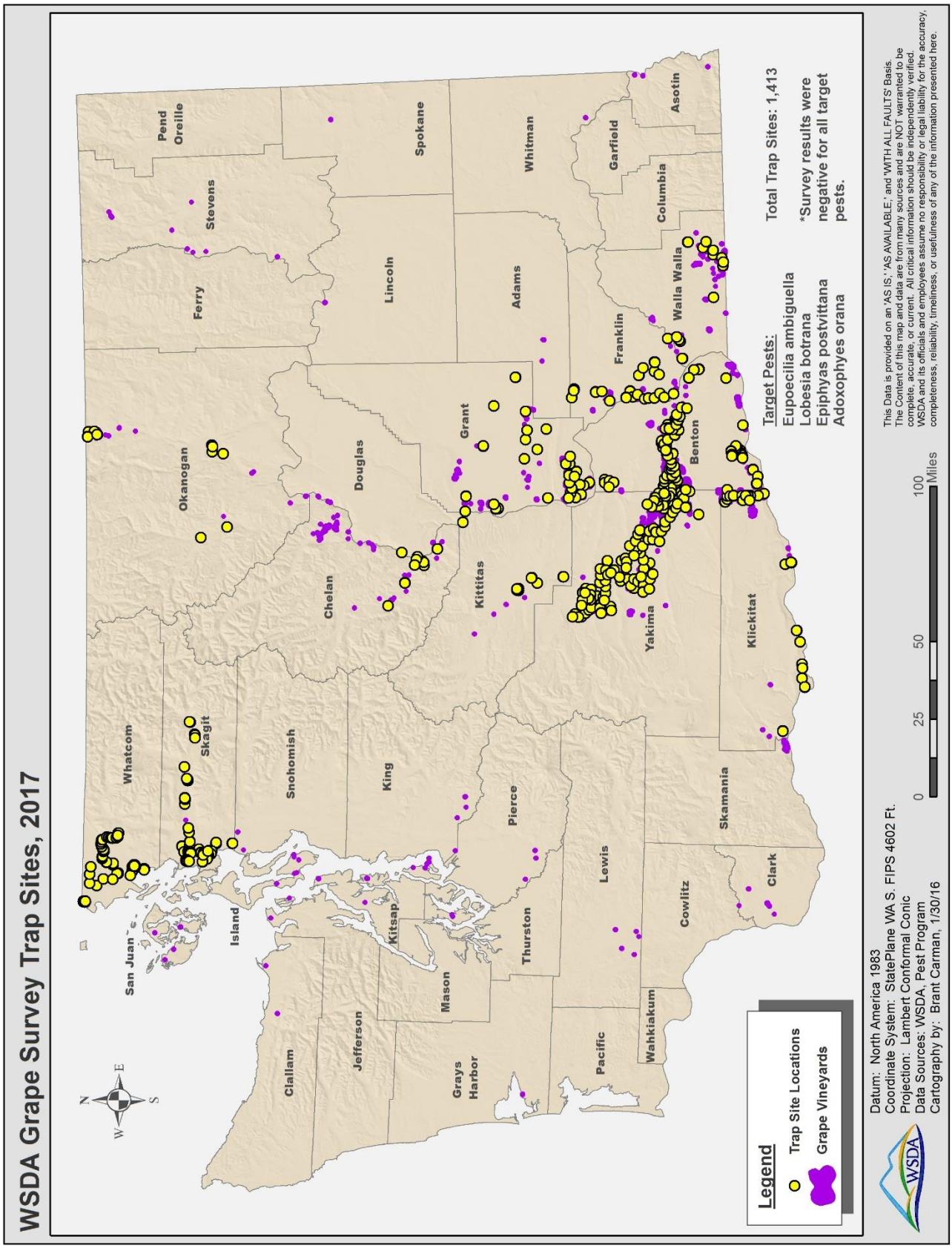
14 Counties surveyed: Benton, Chelan, Douglas, Franklin, Grant, Kittitas, Klickitat, Okanogan, Skagit, Skamania, Spokane, Walla Walla, Whatcom, and Yakima

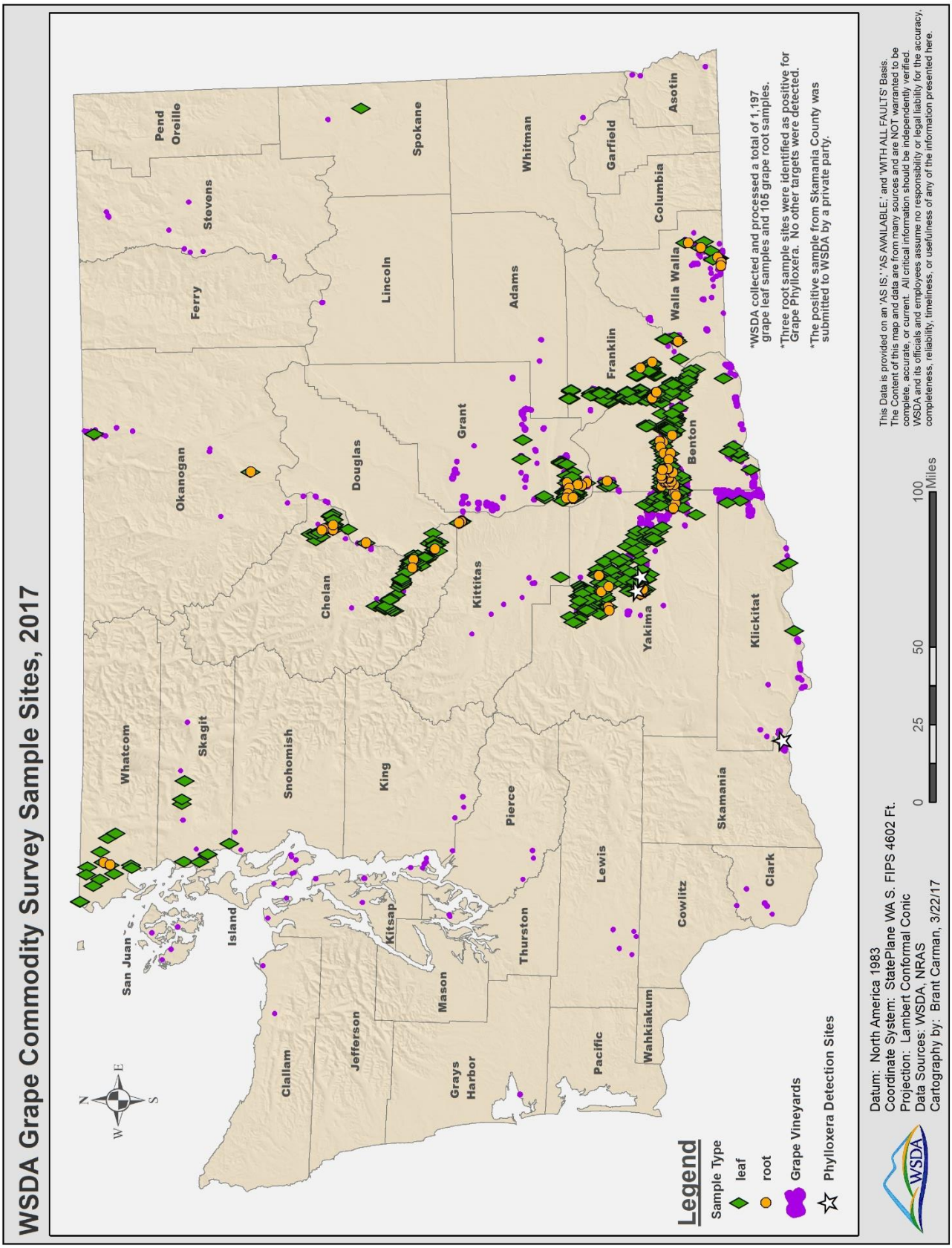
Total insect traps: 1,564

Total leaf sites sampled: 1,197

Total root sites sampled: 105 (includes the sample sent by grower after survey ended)

Pests/Diseases found: *Xylella fastidiosa* (1 positive), Grape Phylloxera (3 positives)


WSDA Grape Survey Trap Sites, 2017
Legend
Trap Site Locations
Grape Vineyards
Target Pests:
Eupoecilia ambiguella
Lobesia botrana
Epiphyas postvittana
Adoxophyes orana
Total Trap Sites: 1,413
*Survey results were negative for all target pests.
Datum: North America 1983
Coordinate System: StatePlane WA S. FIPS 4602 Ft.
Projection: Lambert Conformal Conic
Data Sources: WSDA, Pest Program
Cartography by: Brant Carman, 1/30/16
0 25 50 100 Miles
This Data is provided on an 'AS IS,' 'AS AVAILABLE,' and 'WITH ALL FAULTS' Basis.
The Content of this map and data are from many sources and are NOT warranted to be complete, accurate, or current. All critical information should be independently verified.
WSDA and its officials and employees assume no responsibility or legal liability for the accuracy, completeness, reliability, timeliness, or usefulness of any of the information presented here.
Whatcom
Skagit
San Juan
Island
Snohomish
King
Kitsap
Mason
Thurston
Pierce
Lewis
Cowlitz
Wahkiakum
Pacific
Grays Harbor
Jefferson
Clallam
Chelan
Douglas
Okanogan
Kittitas
Grant
Yakima
Benton
Franklin
Walla Walla
Columbia
Garfield
Asotin
Adams
Whitman
Lincoln
Spokane
Ferry
Stevens
Pend Oreille
Klickitat
Skamania
Clark


WSDA Grape Commodity Survey Sample Sites, 2017
Pend Oreille
Stevens
Spokane
Ferry
Lincoln
Whitman
Adams
Garfield
Asotin
Columbia
Walla Walla
Okanogan
Douglas
Grant
Franklin
Benton
Chelan
Kittitas
Yakima
Klickitat
Whatcom
Skagit
Snohomish
King
Pierce
Skamania
Clark
San Juan
Island
Kitsap
Thurston
Lewis
Cowlitz
Mason
Jefferson
Grays Harbor
Pacific
Wahkiakum
Clallam
N
E
S
W
Legend
Sample Type
leaf
root
Grape Vineyards
Phylloxera Detection Sites
*WSDA collected and processed a total of 1,197 grape leaf samples and 105 grape root samples.
*Three root sample sites were identified as positive for Grape Phylloxera. No other targets were detected.
*The positive sample from Skamania County was submitted to WSDA by a private party.
Datum: North America 1983
Coordinate System: StatePlane WA S. FIPS 4602 Ft.
Projection: Lambert Conformal Conic
Data Sources: WSDA, NRAS
Cartography by: Brant Carman, 3/22/17
0
25
50
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Miles
WSDA
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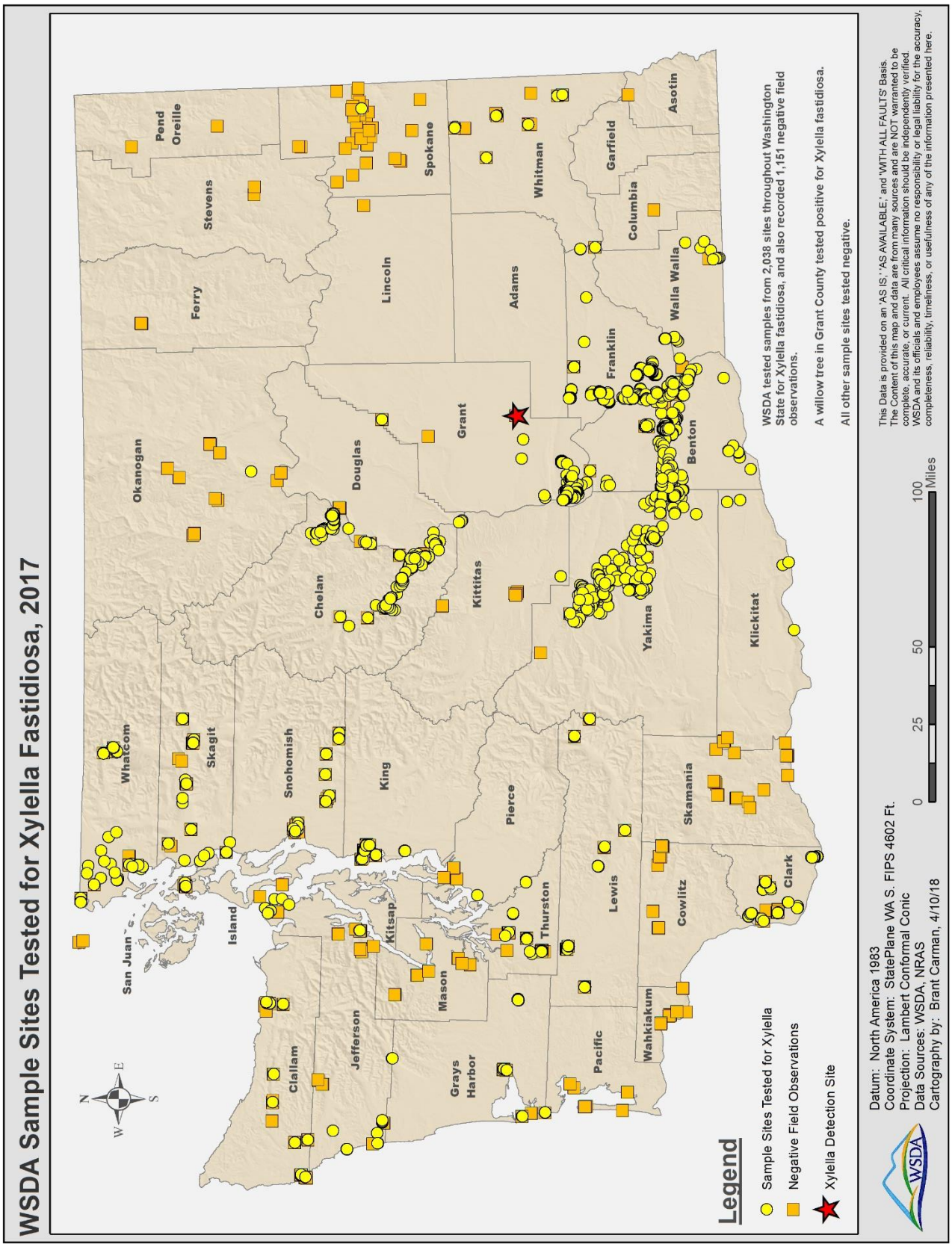
WSDA Sample Sites Tested for Xylella Fastidiosa, 2017
Legend
Sample Sites Tested for Xylella
Negative Field Observations
Xylella Detection Site
WSDA tested samples from 2,038 sites throughout Washington State for Xylella fastidiosa, and also recorded 1,151 negative field observations.
A willow tree in Grant County tested positive for Xylella fastidiosa.
All other sample sites tested negative.
Datum: North America 1983
Coordinate System: StatePlane WA S. FIPS 4602 Ft.
Projection: Lambert Conformal Conic
Data Sources: WSDA, NRAS
Cartography by: Brant Carman, 4/10/18
0 25 50 100 Miles
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Pend Oreille
Stevens
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Clark
San Juan
Island
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Cowlitz
Mason
Jefferson
Clallam
Grays Harbor
Pacific
Wahkiakum

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Moth photos: T. M. Gilligan & M. E. Epstein / TortAI (http://idtools.org/id/leps/tortai/)
Phylloxera leaf gall photo: (http://entoweb.okstate.edu/ddd/insects/grapephylloxera.htm)
Other Phylloxera photos: root nodules by D. Soumi, insect by K. Buckley / WSDA
Australian grapevine yellows photos: Peter Magarey, Disease Diagnosis (http://www.winetitles.com.au/diagnosis/details.asp?view=114#noteslink)
Flavescence doree photo 1: Joseph Klement (https://commons.wikimedia.org/wiki/File:Flavescence_dorée_1.jpg)
Flavescence doree photo 2: Sabrina Herndl-Lanz (https://commons.wikimedia.org/wiki/File:FD_S_Herndl_Lanz_2009.jpg)
Rotbrenner photos: FactorHumus (https://twitter.com/FactorHumus/status/903559329374232576)
Pierce's Disease photo: Jack Kelly Clark / University of California (https://www.winesandvines.com/template.cfm?content=161735&section=news)

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