

Renewal Progress Report for CDFA Agreement Number 06-0617-SA

Project title: “Mapping Pierce's Disease and vector populations in the southern San Joaquin Valley and developing a dynamic model to assess management strategies.”

Time period covered: October 1, 2016 – March 31, 2017

Key personnel

Last Name, First Name	Institutional Affiliation	Role on Project
PI:		
Neil McRoberts	Plant Pathology Department, University of California, Davis	Project Leader
Co-PI:		
Sandra Olkowski	Plant Pathology Department, University of California, Davis	Cooperator
Other Key Personnel:		
David Bartels	USDA-APHIS PPQ	Cooperator
David Haviland	Kern County UCCE	Cooperator
Mark Sisterson	USDA-ARS	Cooperator

Introduction

Reports of increasing incidence of Pierce's Disease (PD) in the southern San Joaquin Valley in recent years have prompted concern among growers. Well-established, and previously successful, area-wide management practices of glass-winged sharpshooters (GWSS) do not appear to be controlling the disease. Understanding how and why transmission by GWSS of the causative pathogen, *Xylella fastidiosa* (*Xf*), is changing over time and space is essential in order to efficiently and effectively interrupt transmission.

Controlling PD hinges on controlling GWSS. GWSS and grapes are not, however, a closed system. Citrus and grapes both act as GWSS hosts and as *Xf* reservoirs, although citrus does not manifest disease. Further, windbreaks are believed to provide havens for GWSS. These three groups exist in close proximity in the General Beale area outside of Bakersfield in Kern County. This enclosed, well-described area presents a unique opportunity to elucidate population-level *Xf* transmission dynamics in a multi-use scenario. Findings will benefit not only local growers but may be generalized to make evidence-based recommendations in other California vineyards that are adjacent to citrus, windbreaks, or other potential GWSS and/or *Xf* harbors. Identifying a spatial risk gradient regarding proximity to citrus (even assuming citrus growers were taking GWSS control measures) in particular would be of immediate use to growers.

The observation that PD incidence is increasing despite orchestrated area-wide management of GWSS is worrying but perhaps not surprising. It is not realistic to expect static management tactics to consistently return positive results in a dynamic system. For example, environmental changes in degree days may affect GWSS development and activity in ways that permit the insect to evade set spray schedules. A dynamic response to a dynamic system requires that we: (1) identify and define observable processes, and (2) use those observations as building blocks to predict what might happen in the system under further changes. To that end, the overarching goal of this research project is to identify time-varying spatial patterns of PD incidence and GWSS abundance in the context of General Beale, and to incorporate these findings into a dynamic model that can be used to evaluate prospective disease incidence.

Objectives

Objective 1: Compare spatio-temporal patterns of PD-affected grapevines and GWSS populations in the Southern San Joaquin Valley.

Objective 2: Develop a dynamic simulation model of GWSS and PD levels across the southern San Joaquin Valley to evaluate prospects for disease management under changing conditions.

Objective 1

Key events

January 2017 – Sandra Olkowski hired as Postdoctoral Scholar by UC Davis

February 2017 – Received GWSS trap count data from David Bartels

March 2017 – Received PD incidence data from David Haviland

The raw GWSS trap count dataset received in February covers 2001-2016 and consists of ~2.2 million georeferenced records. Data were restricted to the study area, and then cleaned and validated. We are currently working with ~688,000 data points contained within Zone 3 of the CDFA GWSS area wide trapping program. Data were restricted in order to coincide with PD incidence data from the General Beale area.

Preliminary spatial visualization of trap count data are shown below in Figure 1. High trap counts consistently cluster within citrus areas that are adjacent to grapes. These ‘hotspot’ clusters display two potentially important characteristics. First, the highest trap counts vary between years, e.g., the highest count category for 2015 was nearly double that for 2011. Second, clusters are not stationary. Together, these observations strengthen the hypothesis that pockets of GWSS populations are evading area-wide control. We are currently conducting more detailed analyses to show how these escape events are associated with environmental factors and seasonal movement of GWSS populations between crop covers (including windbreaks).

We made a site visit to General Beale in early February, in order to strengthen the real-world foundation for how analyses are designed and conducted in this project. We met with the personnel responsible for annual PD sampling efforts. This led to a contribution regarding

grower management practices that could only be made with first-hand expert knowledge. The final dataset provided by David Haviland in March is not only the first fully georeferenced PD incidence time series for the General Beale area, but also contains critical information regarding within-block weed control and roguing practices.

Objective 2

Mark Sisterson will be visiting UC Davis in April for work sessions with Neil McRoberts and Sandra Olkowski. The goal of this in-person collaboration is to fast track initial development of a dynamic simulation model for *Xf* transmission under changing conditions.

Research Relevance

Results of this research project will demonstrate what factors, over time and space, are associated with increases in GWSS populations, in the presence of area-wide management practices. Understanding when, where, and under what conditions GWSS populations may be escaping area-wide management will be a significant contribution to adaptive management of PD. We will combine these findings with PD incidence in a dynamic disease transmission model. The ultimate result will be a public-facing tool for growers to assess their PD risk based on easily identifiable factors such as weather conditions, vineyard management practices, and proximity to citrus.

Layperson summary of project accomplishments

We collaboratively designed and obtained large, complex datasets for GWSS trap counts and PD incidence. We also began preliminary analyses of GWSS trap count data received in February and PD incidence data received in March. Finally, we ground-truthed steps toward achieving project goals by visiting the study site.

Figure 1: GWSS trap counts between 2011 and 2016.

