Citrus Pest and Disease Prevention Committee (CPDPC)
Interim Science and Technology Subcommittee Meeting
February 9, 2021 Minutes

There was a quorum of the Science Committee and the following were in attendance:

Science Committee Members Present:

Dr. Ed Civerolo*	Dr. Etienne Rabe*	Ram Uckoo*
Aaron Dillon*	Dr. Monique Rivera*	Jack Williams*
Dr. Melinda Klein*		

CDFA Staff:

Karina Chu*	Dr. Marina Kaiser*	David Phong*
Kiana Dao*	Daniel Lee*	Lydia Rodriguez*
David Gutierrez*	Jana Miscevic*	Briana Russell*
Amelia Hicks*	Dr. David Morgan*	ThuyVy Truong*
Victoria Hornbaker*	Alex Muniz*	Jennifer Willems*
Laura Irons*	Keith Okasaki*	
Anmol Joshi*	Lea Pereira*	

Other Attendees:

Bob Atkins*	Jonathan Kaplan*	Cressida Silvers*
Teri Blaser	Mark McBroom*	Keith Watkins*
Holly Deniston-Sheets*	Dr. Neil McRoberts*	Judy Zaninovich*
Rick Dunn*	Margaret O'Neil*	Sandra Zwaal*
Jim Gorden*	Curtis Pate*	

*Participated via webinar

Opening Comments:
Dr. Etienne Rabe called the meeting to order at 1:02 p.m. Throughout the meeting, Dr. Rabe displayed the PowerPoint (PP) slides from the previous Science Subcommittee meeting. These slides summarize the discussion for the southern California Huanglongbing (HLB) program, and were updated from the last meeting using input from Dr. Neil McRoberts, Holly Deniston-Sheets, Anmol Joshi, and Keith Okasaki. No recommendations will be made to the full committee yet. There were no public comments.

Goals of Discussion
Dr. Rabe opened the meeting by identifying the goal of the meeting; to evaluate the southern California HLB program and determine if the program is economically sustainable and scientifically justifiable. Dr. Rabe began the PP discussion by posing two questions: (1) How do we quantify the effectiveness of HLB-positive tree removal, HLB risk-based survey (RBS), and other mitigations to curb the threat of HLB to the

California (CA) citrus industry, and (2) What do we use as a control to quantify this effectiveness? Ram Uckoo suggested the program select the control by trying a different approach to RBS using tiers of risk for areas of asymptomatic trees. Dr. Rabe explained that RBS already considers relative risk levels based on several factors.

Citrus Pest and Disease Prevention Division (CPDPD) Status
Dr. Rabe proceeded to review the CPDPD budget and the CPDPD organizational chart. There were no further comments regarding these topics.

Program Activities
Dr. Rabe continued by presenting a map of the HLB quarantine area and the number of HLB-positive samples collected during RBS. RBS sites are randomly selected within each section, township, range (STR) grid that has an assigned risk level for RBS activities. Victoria Hornbaker suggested CPDPD could perform off-cycle surveys, where areas are selected using local staff knowledge in conjunction with factors including socioeconomic status and proximity to airports and commercial citrus.

Dr. Rabe reviewed the HLB delimitation survey site and sample data. Data showed the number of collected ACP samples relative to plant samples is significantly lower as CPDPD surveyors have observed reduced ACP populations when conducting delimitation surveys. Mr. Joshi explained that each tree that is quadrant sampled is submitted as four separate samples. Ms. Hornbaker further explained that most delimitation survey samples are a single, combined sample. Quadrant sampling is conducted on HLB find site properties or when there is an inconclusive lab result. The plant sample data would need to be re-extrapolated to determine the number of trees sampled.

Dr. Rabe also presented data from HLB treatments and HLB lab diagnostics. Dr. Rabe asked how many samples are processed by each lab, if the CDFA lab and the Citrus Resources Board (CRB) lab have a different cost per sample, and if the $1.3 million HLB delimitation diagnostics budget accounts for both CDFA and CRB labs. Ms. Hornbaker explained that CPDPD pays the same for the CDFA and CRB labs personnel (salaries, overhead, and consumables) at $22 per sample with no profit. Ms. Hornbaker further explained that the CDFA lab staff working on the HLB program are fully supported/funded by CPDPD but are not included in the 168 personnel on the CPDPD organizational chart.

Dr. Rabe shared the timelines for tree sampling and removal, quarantine and treatment area data, and HLB RBS data. The RBS data accounts for statewide survey activities and each new RBS cycle includes different counties and STRs to be surveyed. Ms. Hornbaker stated that CPDPD has requested of Dr. Weiqi Luo with the United States Department of Agriculture (USDA) to not be given counties to survey in far northern California as there is a moratorium on travel (due to COVID-19) and northern counties do not provide a good habitat for ACP. Dr. Rabe expressed interest in determining the percentage of total RBS survey sites that were surveyed in southern California. Ms. Hornbaker pointed out that using the number of sites surveyed per county provides this

percentage and shows that the majority of RBS activities are performed in southern California.

Dr. Rabe reviewed the slides for staff time, sampling and diagnostic costs, and costs associated with the southern California program. The slides show $10 million in total expenditures for the southern CA program, which includes HLB delimitation survey, HLB RBS, HLB diagnostics, HLB eradication treatment, and HLB regulatory activities, and encompasses all CPDPD offices.

Model Evaluation
Dr. McRoberts and Ms. Deniston-Sheets presented results produced by utilizing the agent-based model (ABM) in areas of Ventura county and in comparison to results in the San Gabriel area. The following question was posed to prompt discussion about the model's results: what are the effects of residential control on commercial orchards, and do these controls have significance on disease reduction? Dr. McRoberts stated that the model reflects the delay between when an HLB positive tree has been detected, when the tree is removed, and when treatment occurs in the model simulations.

Dr. McRoberts presented the simulations using the ABM, which support the conclusion that both tree removal and insecticide treatments have an impact on the simulated rate of HLB disease spread to commercial orchards. The model shows that treatments have a greater effect than tree removal on the rate of HLB spread. However, both activities are synergistic and decrease the rate of spread compared to not treating and removing trees. Dr. McRoberts suggested running the model without controls to answer the question about the process for selecting a control to quantify the program's effectiveness.

Dr. McRoberts displayed model simulations for HLB disease spread in commercial groves in Las Posas, Ojai, and Santa Clara areas of Ventura County. He explained the simulation results, pointing out the simulations without controls and the simulations with residential and commercial treatments within a 250-meter radius around commercial citrus. Dr. McRoberts further explained that when running these simulations, his group found that the landscape of the target areas has a significant effect on the rate of disease spread. For example, of the three simulated areas, the Ojai area is most likely to have an increased rate of disease spread when treatment controls are not used due to the presence of several small orchards close in proximity to residential properties. Ms. Deniston-Sheets further explained that this model closely replicates the landscape of the southern California HLB residential program based on data collected from RBS and residential treatments. Ms. Deniston-Sheets suggested discussing at a future meeting the factors considered by the ABM and additional information the committee would like to see from simulations of this model.

Dr. McRoberts displayed model simulations predicting the spread of disease in commercial trees after 20 years. The simulations show that the method of disease introduction to the landscape has a large effect on the potential spread and simulation

results. Bob Atkins asked if the takeaway from these models is that commercial and residential treatments have the most effect on disease spread, and the different areas show variation based on proximity between commercial and residential citrus. Dr. McRoberts confirmed Mr. Atkins question and further summarized that continuing responsive and preventative action is the best way to keep HLB from spreading.

Dr. McRoberts continued by displaying model simulations predicting disease in residential trees after 20 years. The simulations show the rate of HLB presence in residential citrus is high despite CPDPD activities. Dr. McRoberts reiterated that disease spread in commercial citrus is only possible and is heavily affected by the length of interface with residential citrus. The model includes tree removal as a control eliminating tree removal from the model has less of an effect than eliminating treatment. Ms. Hornbaker further explained that HLB is an A-rated federally actionable pest, thus tree removal is required.

Dr. McRoberts presented maps of the landscapes of the areas used in the simulations, the simulated monthly ACP detection numbers, and the average ACP populations and HLB positive trees after 20 years based on various levels of controls applied in the simulations. Dr. McRoberts explained that in all three landscapes, controls result in positive effects, with variations between the landscapes. Ms. Deniston-Sheets clarified that ACP populations in the simulation are assumed to be *Candidatus* Liberibacter asiatica (*C*Las)-negative at the start of the simulation. She further explained that treating the buffer areas around HLB detections helps to eliminate any *C*Las-infected psyllids, therefore reducing the risk of HLB disease spread. In summary, controlling the spread of *C*Las-positive ACP is critical; however, entire ACP population control is best to prevent HLB disease spread.

Dr. Rabe reviewed models for estimated HLB disease incidence and areawide treatment refusal rate. Ms. Hornbaker explained that areawide treatment does not occur in Los Angeles and Orange counties therefore there is no areawide treatment refusal data for these areas. Additionally, HLB treatment as a result of an HLB detection is mandatory.

Dr. Rabe reviewed the climactic modeling graphs and the Texas (TX) climate comparison. Ms. Deniston-Sheets explained that desert areas in CA and TX occasionally reach temperatures that are too hot for ACP development so less data is available for comparison in these areas. Ms. Deniston-Sheets added that Dr. Monique Rivera is currently testing the effect of humidity on ACP development. Dr. Rabe requested additional counties and areas in Florida be included to add more information to the climate comparison.

Dr. McRoberts presented the Cambridge Modeling Interface (CMI). He explained that in addition to the ABM, the CMI is used to create more disease spread simulations for the southern California HLB program. Dr. McRoberts' group is currently modifying the CMI model simulations to more closely replicate the ABM. Dr. McRoberts stated this model

works on a larger scale, has less detail, and less alterable factors in relation to the ABM. The model also does not differentiate between residential and commercial citrus if a target area has a low density of citrus.

He continued by presenting two-year and six-year projections produced by CMI simulations. The model considered multiple scenarios including simulations where no controls were used, infected tree removal only, ACP suppression only, and with both infected tree removal and ACP suppression. The simulations show that implementing both controls decreases disease spread by 50 percent compared to simulations where no controls are used. Additionally, the model showed that ACP control impacts the rate of disease spread more than infected tree removal. Ms. Hornbaker reiterated that the cumulative effect of tree removal and ACP suppression creates a positive feedback loop of HLB disease suppression. Dr. McRoberts further stated that insecticide treatments around HLB detections eliminates psyllids that have the highest amount of the *C*Las bacterium, and therefore is most effective at HLB disease suppression. Mr. Atkins pointed out that these models are focused on the natural movement of the disease rather than the impact of artificial movement by humans and is therefore important to consider regulatory citrus movement controls as an important risk factor.

Dr. Rabe closed the meeting by reviewing and suggesting changes to the remaining PP slides regarding practical considerations, list of impediments for CDFA, the area covered by STRs for HLB RBS, questions posed to Dr. McRoberts' group, and the summary for the southern California HLB program.

Closing
Dr. Rabe adjourned the meeting at 3:01 p.m.