Evaluating exposure to *Candidatus* Liberibacter asiaticus (*C*Las) in Southern California

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Executive Summary

On behalf of the Data Analysis and Tactical Operations Center, the McRoberts QBE Lab of UC Davis evaluated methods to describe the extent of dooryard citrus tree exposure to the *C*Las bacterium and the associated huanglongbing (HLB) infection in the quarantine zone of Southern California. The remit of the project team was to determine whether it is possible to give an evidence-based description of exposure to *C*Las among populations of citrus trees in the urban landscape of southern California, using data available from the CPDPP activities.

After standardization and text cleaning of the datasets, data from surveys of both citrus trees and Asian Citrus Psyllid (ACP) from 2012 up to June 2018 were available for analysis. These comprised 100,162 individual trees, including 659 with positive HLB infections, and 134,977 ACP detections, including 145 confirmed with *C*las.

Fairly robust infection gradients were identifiable across all infection sites. For any given known HLB positive tree, the probability of finding additional HLB-positive trees declined with distance, indicating the contagious nature of disease spread. This is an initial finding that can be used to describe the spatial nature of exposure to *C*las in the southern California urban landscape.

When the separation distances between known positive trees are placed in rank order from smallest (*i.e.* closest infections) to largest and then the cumulative total of infected trees is counted until all known infected trees are accounted for, the following results are obtained from the cumulative distribution:

- 80% of all known positive trees occurred within 80m of another known positive
- 85% of all known positive trees occurred within 110m of another known positive
- 90% of all known positive trees occurred within 170m of another known positive
- 95% of all known positive trees occurred within 320m of another known positive

The proximity relationship between ACP confirmed to be carrying CLas and confirmed tree infections follows a similar trend to that found among infected trees but was not as tight; this is largely because there are very few Clas+ ACP detections relative to HLB+ tree detections. These results can be used to define a spatial model of exposure, based on the scales over which the disease spreads and a tree removal plan might operate.

Because healthy and diseased trees accumulate differently with distance from an infected tree, it may be possible to establish a clearing policy that removes most infected trees while minimizing economic damage from removing healthy trees. It should be borne in mind that a policy developed based on the aggregate relationship derived from data across all infection sites will vary with location in its efficacy in removing infection and the level of economic loss it causes through removal of healthy trees.

Assuming all infected trees operate in their environments in the same way, a clearing radius of 175m around each infected tree would lead to 90% of all known infected trees being destroyed. At the same time, this would require the removal of an estimated 9,184 citrus trees in an area of 22.5 ac. Of these, 8,590 trees are not currently labeled as infected, although the degree of cryptic infection is still unknown.