Effective and equitable transport quarantines for bulk citrus movement in California

A Policy briefing paper prepared by

Neil McRoberts *Quantitative Biology & Epidemiology Lab, Plant Pathology Dept, UC Davis, Davis CA 95616*

Beth Grafton-Cardwell, Dept of Entomology, UC Riverside and Director of *Lindcove Research and Extension Center, UC Riverside, 22963 Carson Ave, Exeter, CA 93221*

Introduction

Unintentional movement of Asian citrus psyllids with fruit shipments by road transport is one of the known high risk factors in the spread of both the vector and the pathogen – *Candidatus Liberibacter asiaticus* (*C*Las) that it carries. The risk associated with transport corridors for movement of ACP and disease spread was quantified during the Florida epidemic. Data on ACP finds in Central and Northern California to date are consistent with the idea that here, as in Florida, the major transport corridors for commercial citrus fruit movement are acting as conduits for dispersal of ACP; a large proportion of the ACP find sites and consequent treatment areas in the San Joaquin Valley lie inside or close to a 6.5 mile area of high risk extending either side of highways (see Figure 1). HLB has been found in more than 25 residential trees in Los Angeles and has recently been found in Mexicali. HLB will continue to spread in the bodies of psyllids as they move naturally and as they move on fruit shipments.

The organization of the within-state regulation of citrus fruit movement is currently under discussion and a new set of operating procedures has been suggested by the California Department of Food and Agriculture (CDFA). Since the proposed regulations are open for discussion we offer, in this briefing paper, a discussion of the issues from a scientific perspective.

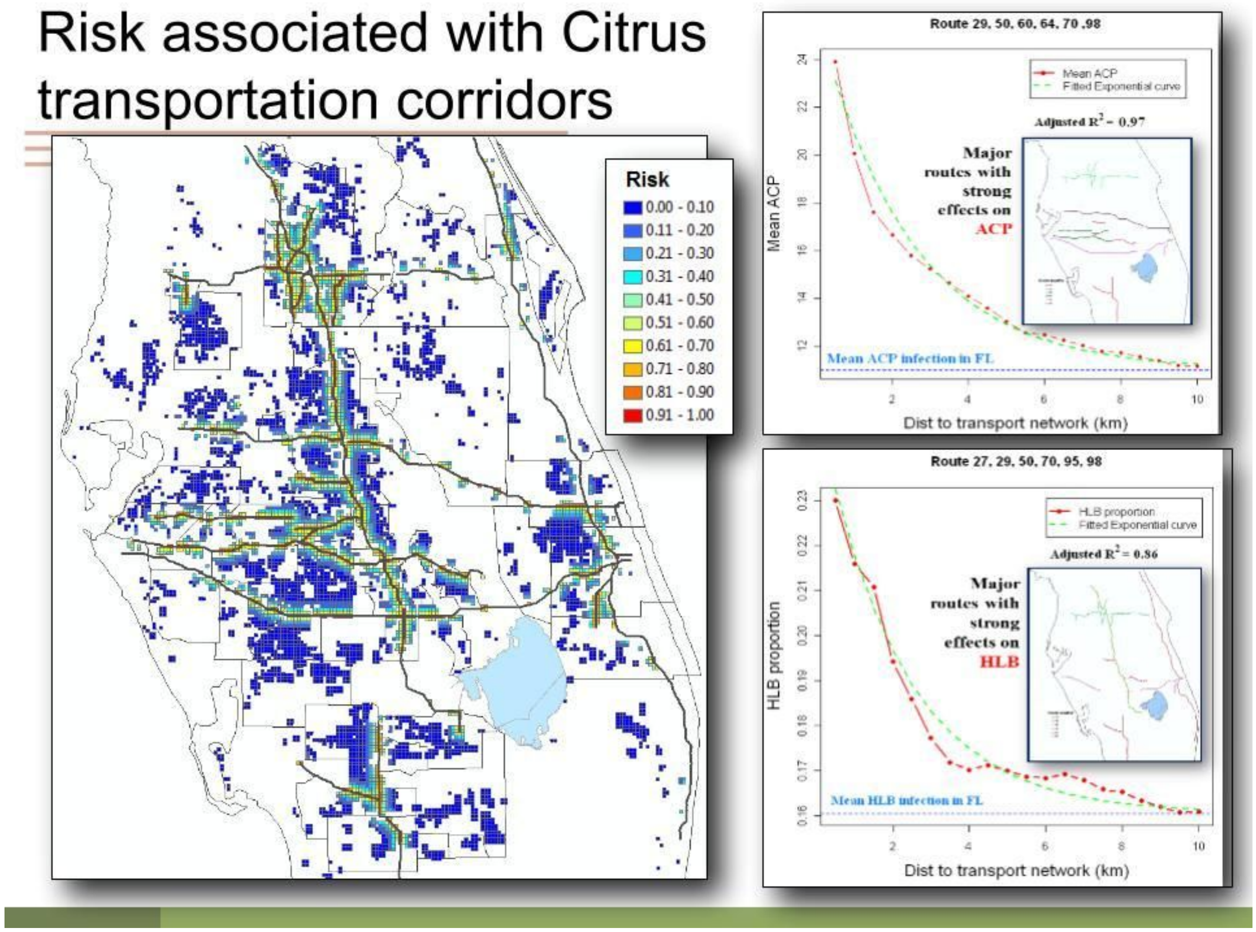

Figure 1. Data from Florida linking fruit transport corridors to ACP numbers and risk of HLB incidence. The relationships are extremely strong - both risk factors decline exponentially with distance from highways over a range of approximately 6.5 miles (10km) [Courtesy of T.R. Gottwald and W. Luo, USDA-ARS Sub-Tropical Plant Pathology Lab, Ft Pierce, FL.]

The link between fruit transport and ACP and HLB risk established in FL is emerging in the pattern of ACP finds in CA, but we also know there are other high risk factors for HLB, so design of regulated areas we propose here also takes into account the current pattern of HLB risk across the state (see Figure 2).

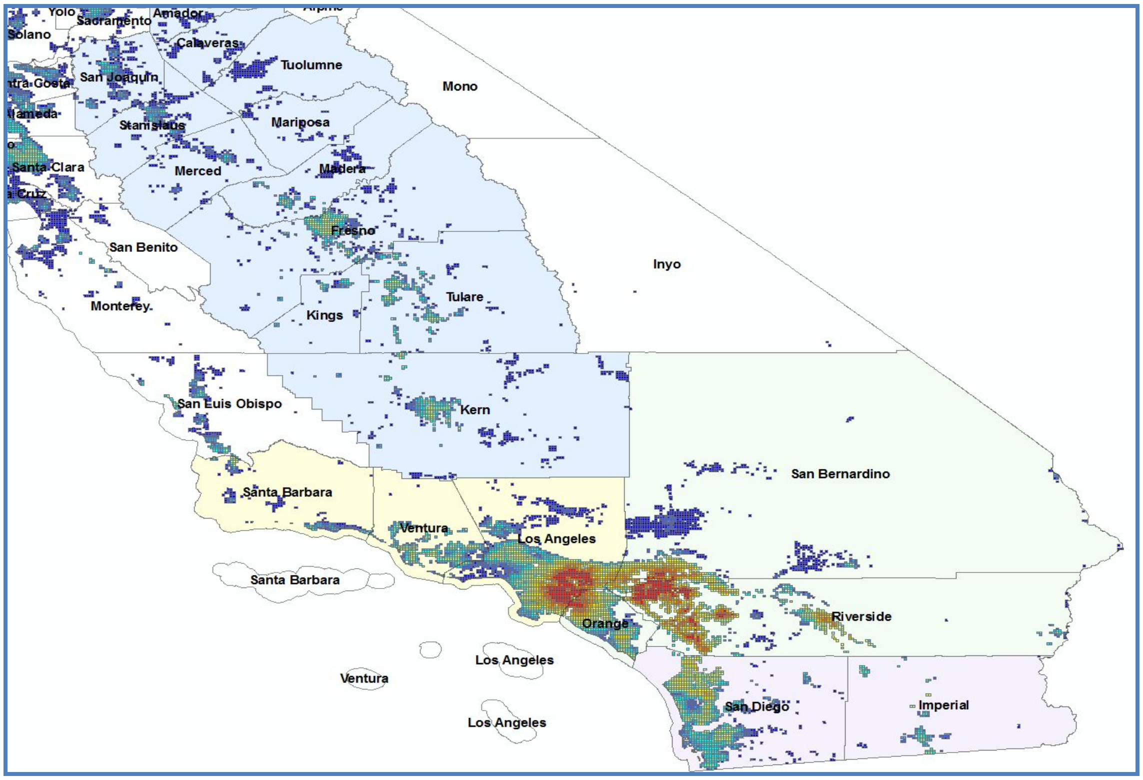

Figure 2. Distribution of HLB risk across California. Dark blue squares indicate lower risk, paler blue through red indicate increasing risk.[Courtesy of T.R. Gottwald and W. Luo, USDA-ARS Sub-Tropical Plant Pathology Lab, Ft Pierce, FL.]

The USDA-ARS HLB risk model contains a large number of risk factors which contribute to the overall risk level assigned to each 1 square mile grid square, including population demographics, census travel data, mutual proximity between commercial and urban citrus, transport networks, densities of psyllids and elevation. Figure 2 shows that Los Angeles, Orange, San Bernardino and Riverside are highest risk areas, but the San Joaquin Valley also has areas of risk, notably Fresno and Bakersfield.

The elements of the problem

- ACP spread is accelerated by psyllids riding on infested fruit. Passive transport on fruit loads massively increases the rate of spread across a landscape.
- The spray and move program is clearly not eliminating psyllids from orchards and is allowing an unacceptable number of psyllids to be transported to packing houses and juice plants around the state.
- Current enforcement of fruit movement regulations is weak, weaker than regulations for glassy-winged sharpshooter.

- The basic theory of population dynamics tells us that restricting population increase and spread will be best achieved by subdividing the landscape into a large number of patches and isolating the patches from one another as much as possible (think of it like building an unsinkable boat by constructing it from isolated compartments).
- However, when we subdivide the state into regions, the cost of treating fruit before it moves between regions is high. But this short-term increase in costs will greatly increase the long-term sustainability of citrus by limiting HLB spread.
- Regulations of this type only work well if everyone obeys them. But, if enough people participate, there is the temptation for some people to freeload – especially when enforcement is weak – and it becomes rational not to participate. The result is reduced effectiveness of the program and spread of the disease. Therefore, full participation is critical.
- There is a temptation to allow untreated movement of fruit from areas that have low psyllid populations. However we do not know where HLB is or where it will appear next, and it could appear (due to grafting or psyllid movement) in an area that has a low psyllid population. Therefore, the units of quarantine should not only be small, but regulated in both directions.

Industry regulated areas

A simple workable solution, based on scientific principles, is as follows:

- Identify all of the fruit transport patterns (sources and destinations).
- Define regulated areas on the basis of locations of commercial citrus relative to packing houses and juice plants, natural geographical barriers to ACP movement, HLB high risk areas identified by Dr. Gottwald, and other factors that make scientific sense;
- Stipulate that any fruit leaving one area, irrespective of destination, must be free of leaves and twigs, washed, brushed or fumigated and transported in a tarped or enclosed vehicle
- Allocate sufficient resources for enforcement, such as packing house requirements, so as to prevent free-loading

Results of Regulation

Under this approach we achieve an equitable distribution of cost because the fruit entering an area will have been treated by the sender. So the burden of treatment rests on the shoulders of the exporting areas. If compliance is required at packing houses and juice plants and enforced through removal of compliance agreements, the sender and recipient of fruit loads will be tied together in shared responsibility. The fact that areas which are net exporters pay more, will act as an incentive to develop local packing facilities and further restrict unintentional ACP movement with citrus fruit.

In summary, the industry should immediately design regulated areas on the basis of maximizing benefits of geography to restrict ACP dispersal, taking into account HLB risk independent of ACP population sizes and based on the principle that fruit doesn't move without treatment. Built into the system should be the ability to change the regulated areas as HLB outbreaks occur.

Working through the guidelines we have suggested, we derived the following initial list of suggested 8 regulated areas (also see Figure 3).

1. ***Imperial/Coachella***: This area has increased risk as a result of proximity to known HLB in Mexicali.
2. ***San Diego***: This area has increased risk as a result of proximity to potential HLB risk in Tijuana and San Diego city.
3. ***Riverside/LA/San Bernardino***: This area has increased risk from the HLB-infected urban area of LA and the large extent of urban/commercial interface.
4. ***Ventura/Santa Barbara***: This region needs protection from HLB incursion from the LA area and from fruit brought from other areas for packing for export.
5. **Central Coast/Monterey**: Commercial citrus in this area is relatively isolated from commercial sources of risk, but there is elevated risk from small urban centers and field worker communities which represent elevated sources of HLB risk.
6. **Southern San Joaquin Valley/Kern**: There is elevated risk in this area from multiple sources - urban Bakersfield, various farm-worker communities, volume of through traffic, proximity to LA and coastal areas.
7. **Central and northern SJV/Tulare/Fresno/Madera**: High risk areas in Fresno, farm-worker communities, volume of through-traffic and density of citrus production and processing all increase risk in this area.
8. **Northern production areas**: There is relatively low risk in commercial citrus in these areas due to isolation, but higher risk associated with some urban populations.

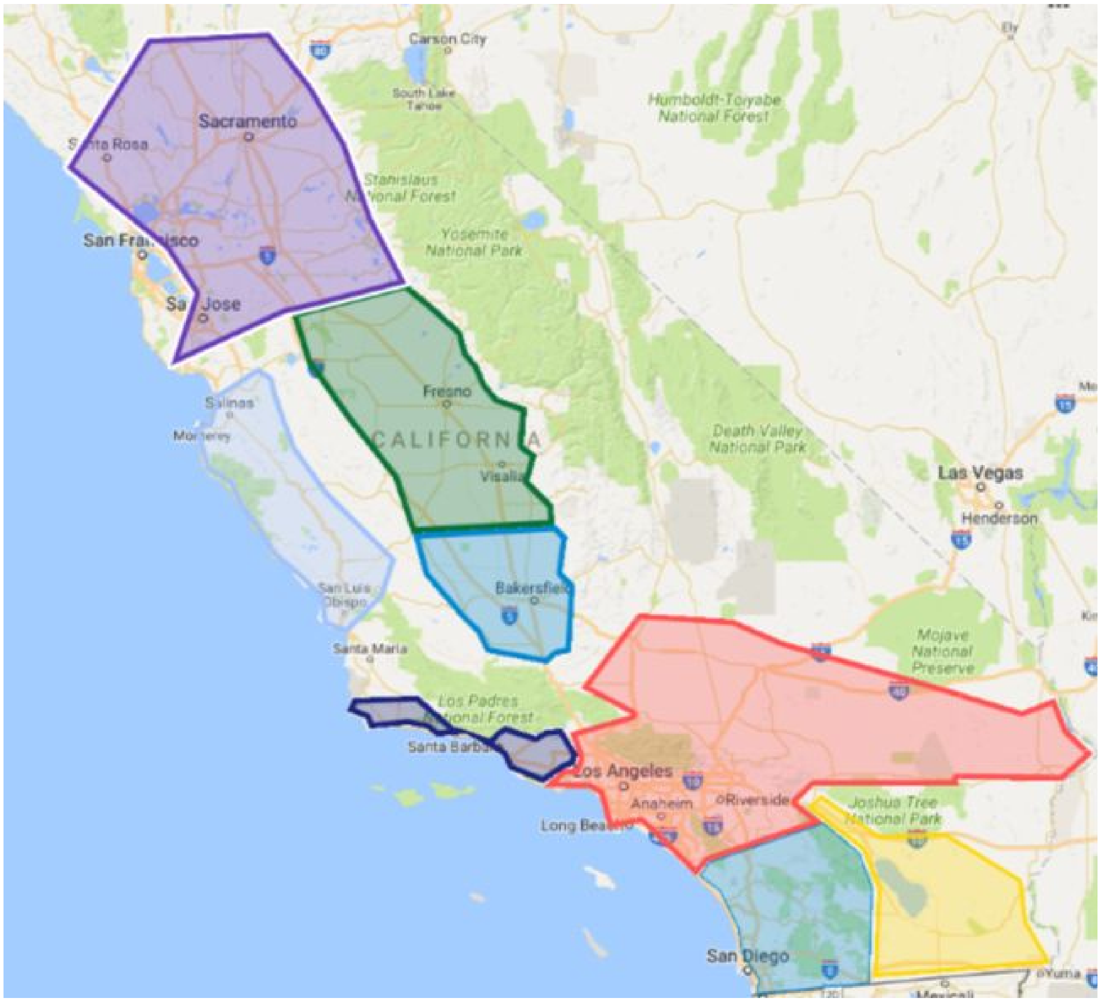

Figure 3. Suggested regulated areas for suppressing movement of ACP with fruit transport. Fruit leaving any of these areas would require washing/fumigation and tarping or completion of final packing into closed boxes.