

California's Battel with ACP and HLB

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The Tristeza Virus and it's Impacts on California Citrus

Tristeza, the most serious viral disease of citrus worldwide, killed 3 million citrus trees in Southern California in the 40's and 50's

- Quarantine still in place today



Discovery of ACP in California

August 2008



1st International Conference on HLB

December 2008 in Orlando, Fl.

- ▶ 427 conference attendees from around the world participated in identifying and prioritizing research projects
- ▶ Industry Members from California attended and began developing strategies to protect the state

Meeting the Challenge of the Asian Citrus Psyllid in California Nurseries

June 11 & 12, 2009-Riverside, California

(<http://www.acpnurseryworkshop.ucr.edu>)

- California has the opportunity to learn from other areas mistakes
- Take home message is get nurseries protected before its too late!

- Three-Pronged Strategy to Fight HLB -

(1) keep nursery stock clean

(2) suppress Asian citrus psyllid (ACP) populations

(3) remove diseased trees upon confirmation of the presence of 'Candidatus Liberibacter', aka HLB

California Citrus Nursery Industry Agrees to Self Regulate

▶ SB 140 Nov. 2, 2009

- ▶ Mandates Source Trees must be grown inside “Insect Resistant Structures”
 - ▶ Mother Trees January 2012
 - ▶ Increase Trees January 2013
- ▶ Outlines Mandatory Testing Protocols

Impacts of Regulations on California's Citrus Nursery Industry

- ▶ Today's Citrus Nurseries in California are highly regulated:
 - ▶ Inspections every 30 days to insure the integrity of the structures
 - ▶ Mandatory testing of all Mother Trees for all known graft transmissible diseases
 - ▶ Extremely high level of confidence that production nurseries are making clean trees
 - ▶ regulating for very unlikely events has potential to cause unintended problems
 - ▶ Breach issues

ACP Regional Quarantine - Nursery

- ▶ Production and wholesale nurseries are regulated establishments, subject to inspection, and required to treat host nursery stock.
- ▶ Nurseries must treat and tag all host plants offered for sale or distribution every 90 days using a foliar and systemic insecticide.
- ▶ Treated and tagged host plants must remain within the quarantine zone unless moved under the terms of a special permit.
- ▶ CDFA issues Quarantine Commodity (QC) permits to allow nurseries to ship host stock in an approved manner that would otherwise be prohibited by the regulation.



Voluntary Pre-HLB Quarantine Nursery Program

- ▶ Created a new voluntary program for nurseries to move outdoor host nursery stock in to an approved exclusionary facility prior to the nursery being included in the HLB Quarantine area
- ▶ Plants will be sampled and tested for HLB every six months
- ▶ Helps nurseries to start the two year period before it is required by the quarantine regulations
- ▶ Provide head start to the nurseries to sell their plants within the contiguous quarantine area immediately
- ▶ Minimize the economic impact on the nurseries

Citrus Pest and Disease Prevention Committee

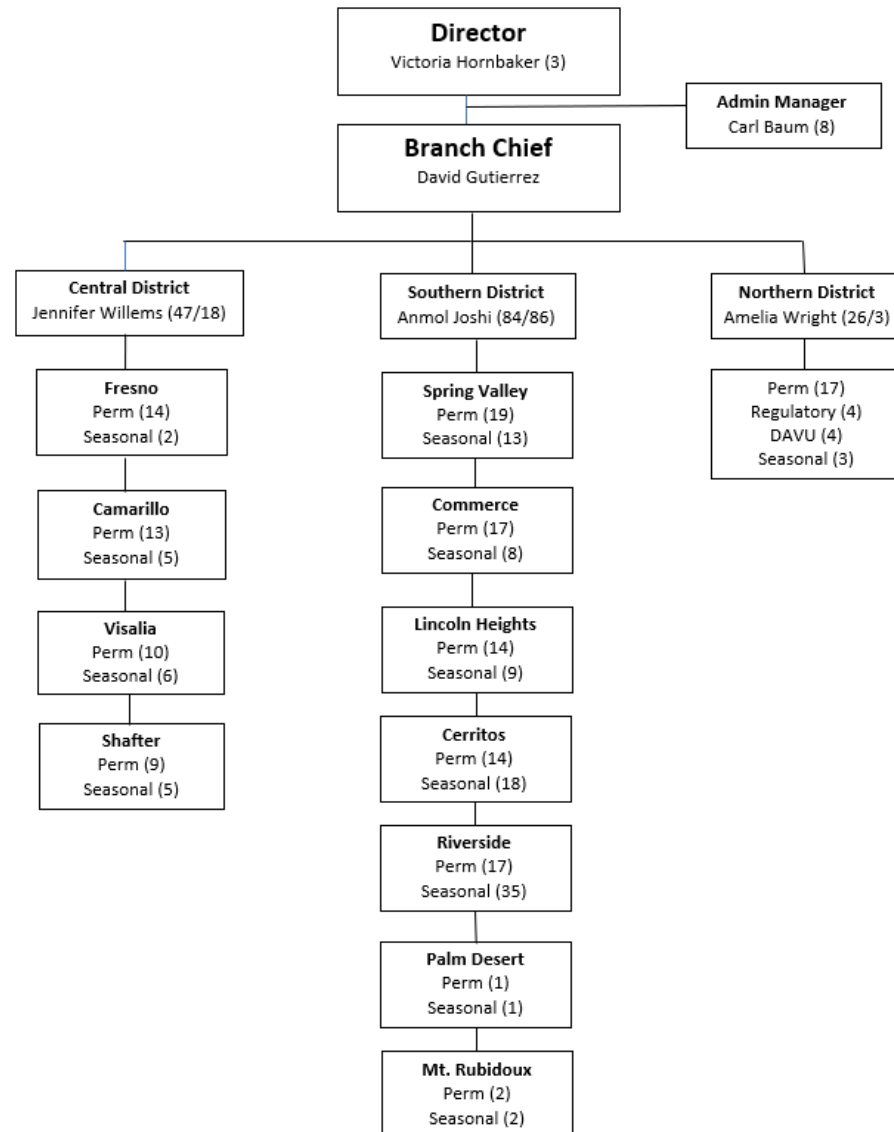
- ▶ CPDPC was established by AB 281 in 2009
- ▶ Develop a statewide citrus specific pest and disease work plan that includes, but is not limited to, the following:
 - ▶ Outreach and education programs for residents, local communities, groups, on the prevention of citrus pests and diseases.
 - ▶ Programs for surveying, detecting, analyzing, and treating pests and diseases specific to citrus.
- Advise the Secretary on implementation of the work plan, including:
 - ▶ Annual assessment rate and annual budget.
 - ▶ Adoption of regulations consistent with the powers and duties of the committee.

2018 CPDPD Strategic Plan

1. Detect and eradicate HLB
2. Control ACP movement and enforce regulations
3. ACP control and suppression
4. Improve data technology, analysis, and sharing
5. Outreach

http://www.cdfa.ca.gov/citruscommittee/docs/CPDPC_StratPlanning.pdf

CPDPD Organizational Chart & Locations



| FY 21-22 Budget Display October 1, 2021 - September 30, 2022 | | | | |
|---|----------|-----------|---------------|----------------------|
| # | Group | Region | Activity | Approved Budget |
| 1 | ACP Mgmt | Border | Treatment | \$ 625,046 |
| 2 | ACP Mgmt | Central | Survey | \$ 2,659,168 |
| 3 | ACP Mgmt | Central | Treatment | \$ 1,290,726 |
| 4 | ACP Mgmt | Northern | Survey | \$ 1,540,124 |
| 5 | ACP Mgmt | Northern | Treatment | \$ 445,718 |
| 6 | ACP Mgmt | Southern | Treatment | \$ 1,815,452 |
| 7 | ACP Mgmt | Southern | Survey | \$ 281,149 |
| 8 | ACP Mgmt | Statewide | Biocontrol | \$ 1,686,369 |
| 9 | ACP Mgmt | Statewide | Survey | \$ 3,000,000 |
| 10 | ACP Mgmt | Statewide | Regulatory | \$ 3,215,894 |
| 11 | HLB Det | Border | Survey | \$ 212,795 |
| 12 | HLB Det | Southern | Survey | \$ 2,084,691 |
| 13 | HLB Det | Statewide | Survey | \$ 6,532,228 |
| 14 | HLB Det | Statewide | Diagnostics | \$ 3,338,979 |
| 15 | HLB Erad | Southern | Treatment | \$ 5,361,616 |
| 16 | HLB Erad | Statewide | Regulatory | \$ 826,945 |
| 17 | ACP/HLB | Statewide | Admin | \$ 5,852,176 |
| 18 | ACP/HLB | Statewide | Outreach | \$ 2,063,377 |
| 19 | ACP/HLB | Statewide | Data Analysis | \$ 1,547,305 |
| 20 | ACP Mgmt | Statewide | Diagnostics | \$ 209,052 |
| | | | | \$ 44,588,810 |

FY 21-22 Approved Budget

CPDPD Systems Approach

In addition to survey and treatment, the CPDPD employs a systematic approach to eradicate HLB by:

- Enforcing quarantine requirements
- Releasing targeted biocontrol agents
- Coordinated areawide treatments
- Partnering with researchers to improve the scientific approach and facilitate innovation
- Conducting outreach to citrus and nursery industries and the general public

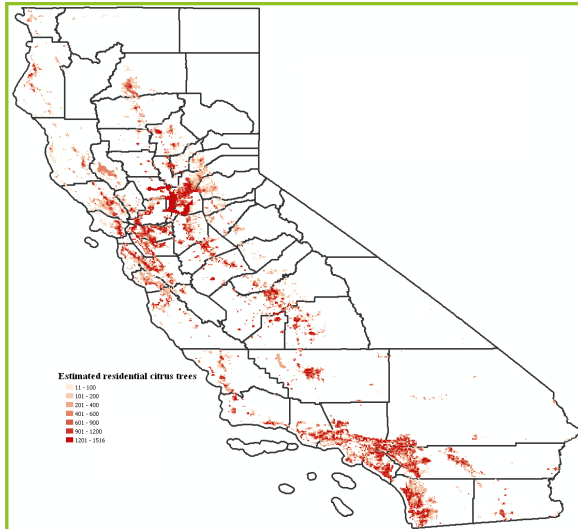


HLB Risk Based Survey

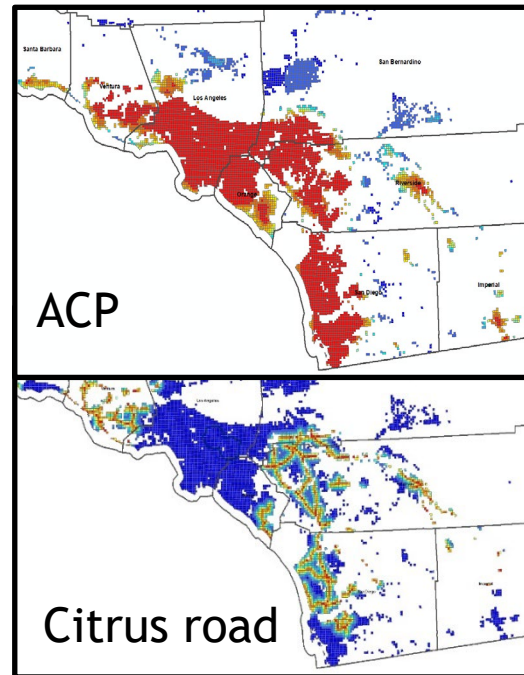
- ▶ Using risk modeling provided by Dr. Tim Gottwald, the following factors are considered when determining risk associated with the Huanglongbing (HLB) disease:
 - Residential citrus population and distribution
 - Population demographics
 - Weather effects
 - Citrus transportation routes
 - Potential to spread the Asian citrus psyllid (ACP) from commercial nurseries, big box stores and citrus green waste
 - Areas infested with ACP
 - Proximity to commercial citrus groves
- ▶ Goal is to complete two cycles per year.

Risk-Based Formula

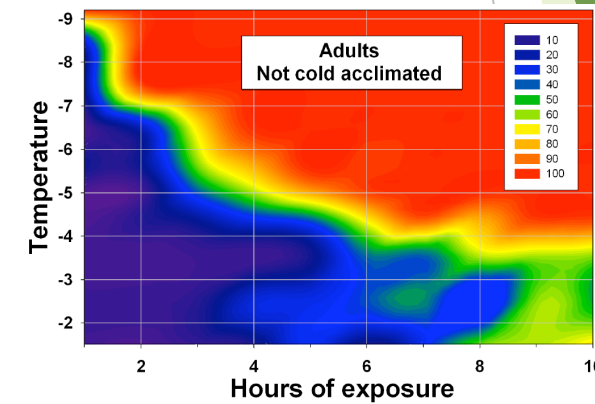
Host Population Maps



Dynamic Risk Factor Models

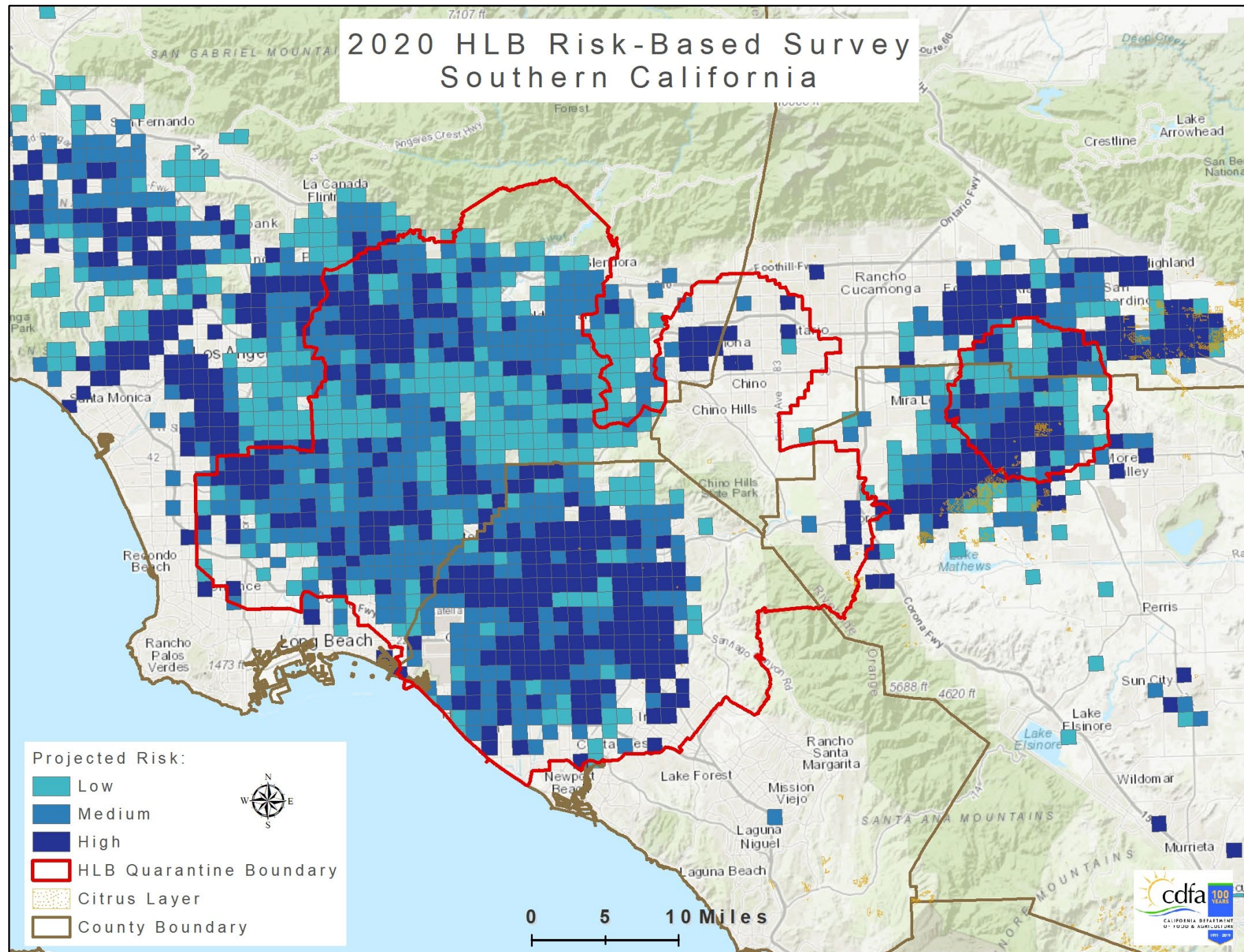


Pest Suitability



$$Final\ Risk = F(Host) * \sum_i w_i Risk_i * G(Pest\ Suitability)$$

2020 HLB Risk-Based Survey Southern California



History of ACP in California

- ▶ 2008 - San Diego and Imperial
- ▶ 2009 - Los Angeles, Orange and Ventura
- ▶ 2010 - Riverside and San Bernardino
- ▶ 2012 - Santa Barbara and Tulare
- ▶ 2013 - Kern and Fresno
- ▶ 2014 - San Luis Obispo, Santa Clara, Madera and San Joaquin
- ▶ 2015 - San Benito, San Mateo and Stanislaus
- ▶ 2016 - Merced, Monterey, Kings and Placer
- ▶ 2017 - Solano, Yolo, Contra Costa and Alameda
- ▶ 2018 - Marin and San Francisco
- ▶ 2019 - Sacramento



Table 1. Tally of positive sites, positive trees, and CLas+ ACP samples by county and city as of 9/2/2022.

| HLB Positive Detections | | | |
|------------------------------|-------------|-------------|---------------|
| City | # Sites | # Trees | # ACP samples |
| Orange County | | | |
| Garden Grove | 450 | 699 | 64 |
| Santa Ana | 415 | 584 | 57 |
| Anaheim | 466 | 763 | 103 |
| Westminster | 333 | 525 | 20 |
| Orange | 104 | 138 | 19 |
| Tustin | 12 | 15 | 3 |
| Fountain Valley | 6 | 10 | 2 |
| Huntington Beach | 22 | 25 | 2 |
| Placentia | 9 | 8 | 3 |
| La Habra | 3 | 4 | 1 |
| Fullerton | 4 | 5 | 3 |
| Yorba Linda | 3 | 2 | 2 |
| Irvine | 3 | 2 | 2 |
| Total | 1830 | 2780 | 281 |
| Los Angeles County | | | |
| Whittier | 156 | 195 | 32 |
| Pico Rivera | 109 | 133 | 38 |
| Montebello | 71 | 99 | 1 |
| San Gabriel | 66 | 83 | 6 |
| Rosemead | 23 | 28 | 4 |
| Paramount | 29 | 34 | 4 |
| La Mirada | 30 | 43 | 5 |
| La Puente | 8 | 6 | 5 |
| Norwalk | 9 | 6 | 4 |
| Cerritos | 3 | 2 | 2 |
| Hacienda Heights | 2 | 2 | 1 |
| Lakewood | 5 | 6 | 0 |
| Duarte | 25 | 30 | 3 |
| El Monte | 7 | 6 | 4 |
| South El Monte | 4 | 4 | 2 |
| Alhambra | 1 | 1 | 0 |
| Temple City | 1 | 1 | 1 |
| Compton | 1 | 1 | 0 |
| Glendora | 1 | 0 | 1 |
| South Gate | 7 | 4 | 4 |
| Long Beach | 4 | 2 | 2 |
| Los Angeles | 1 | 0 | 1 |
| Downey | 5 | 10 | 1 |
| Carson | 4 | 3 | 1 |
| Monrovia | 10 | 15 | 0 |
| Rowland Heights | 2 | 0 | 2 |
| Pomona | 4 | 3 | 1 |
| Total | 588 | 717 | 125 |
| Riverside County | | | |
| Corona | 38 | 55 | 18 |
| Riverside | 24 | 26 | 4 |
| Eastvale | 1 | 1 | 0 |
| Jurupa Valley | 8 | 5 | 4 |
| Moreno Valley | 1 | 1 | 0 |
| Total | 72 | 88 | 26 |
| San Bernardino County | | | |
| Rancho Cucamonga | 3 | 7 | 2 |
| Montclair | 6 | 6 | 0 |
| Colton | 6 | 11 | 3 |
| San Bernardino | 2 | 1 | 1 |
| Ontario | 52 | 108 | 18 |
| Fontana | 6 | 8 | 4 |
| Chino | 1 | 0 | 1 |
| Total | 76 | 141 | 29 |
| San Diego | | | |
| Fallbrook | 1 | 0 | 1 |
| Oceanside | 4 | 9 | 4 |
| Pauma Valley | 1 | 0 | 1 |
| Vista | 1 | 0 | 1 |
| Total | 7 | 9 | 7 |
| Grand Total | 2573 | 3735 | 468 |

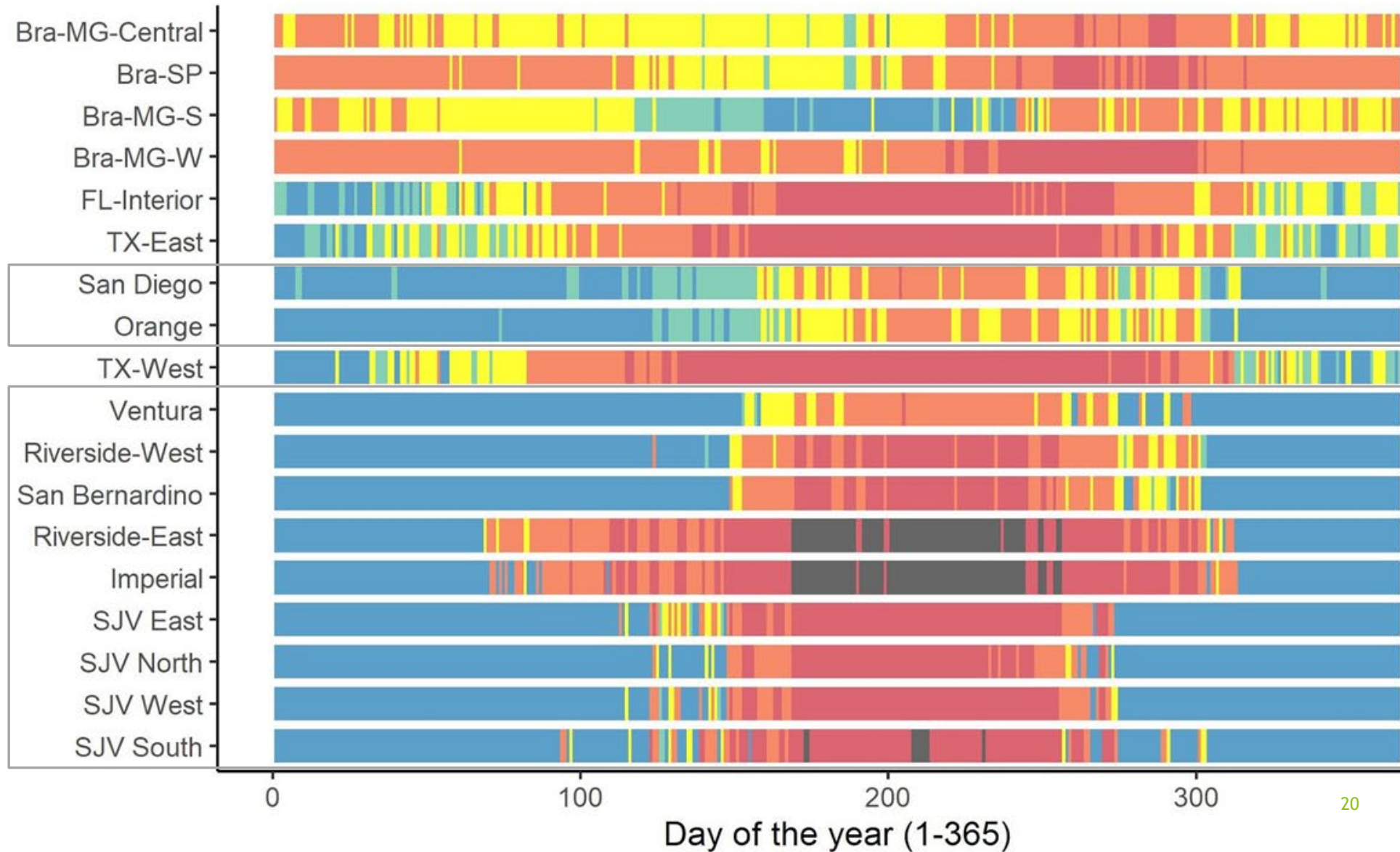
Table 2. Percent positives per county

| County | Sites | Trees | ACP |
|----------------|-------|--------|-------|
| Orange | 71.1% | 74.43% | 60.0% |
| LA | 22.9% | 19.20% | 26.7% |
| Riverside | 2.8% | 2.36% | 5.6% |
| San Bernardino | 3.0% | 3.78% | 6.2% |
| San Diego | 0.3% | 0.24% | 1.5% |
| Total | 100% | 100% | 100% |

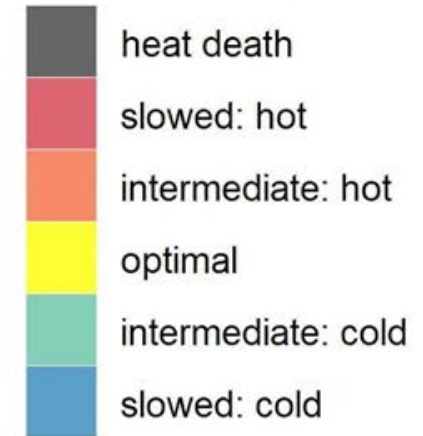
Table 3. Tally of positive samples from Risk-based and HLB Response surveys.

| Sample type | Trees | | ACP | |
|-------------------|-------------|-------------|------------|-------------|
| Risk-based Survey | 134 | 4% | 220 | 47% |
| HLB Response | 3601 | 96% | 248 | 53% |
| Total | 3735 | 100% | 468 | 100% |

Effect of daily min/max temperatures on ACP development ordered by intermediate + optimal days (most to fewest)



ACP Development

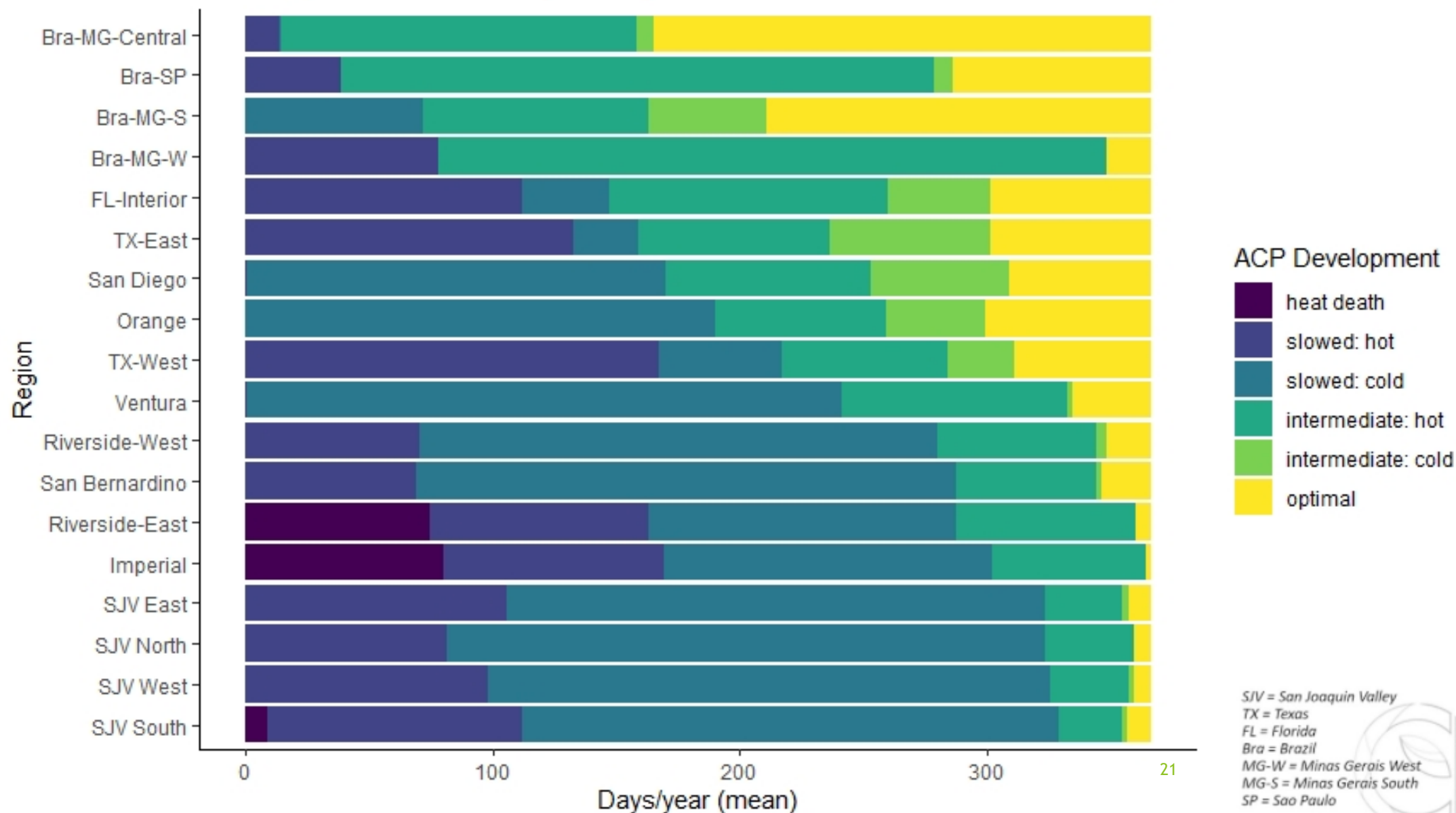


SJV = San Joaquin Valley
TX = Texas
FL = Florida
Bra = Brazil
MG-W = Minas Gerais West
MG-S = Minas Gerais South
SP = Sao Paulo

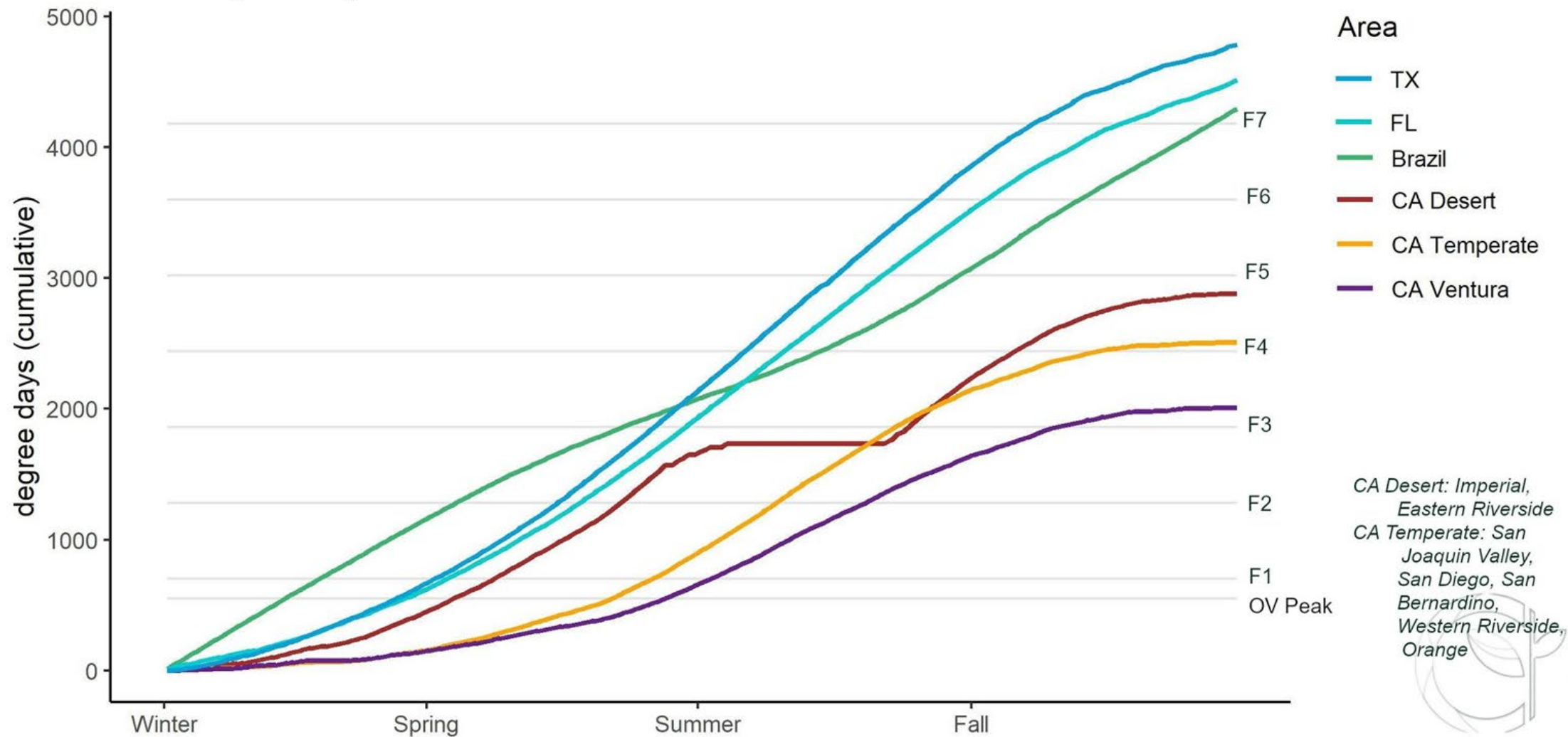


Days/year suitable for optimal ACP development

ordered by most intermediate/optimal days to fewest



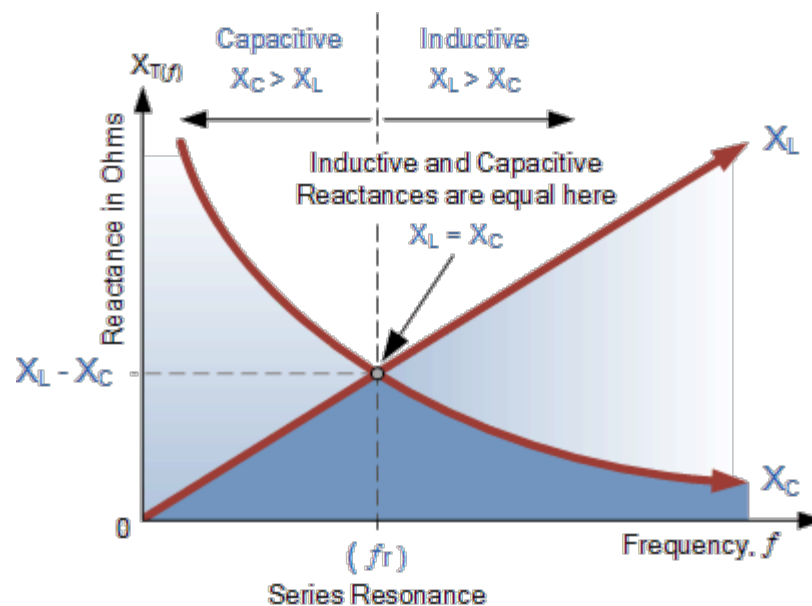
ACP degree days



Imperative the California Citrus Industry keeps up the Fight against ACP and HLB

Due to the incredible efforts on the part of the Growers (CPDPC), Citrus Nurseries and CDFA, we have managed to delay the onset of the worst case scenario for ACP/HLB for a decade

In Florida it took less than 3 years for the entire state to become significantly impacted



Resistant or tolerant trees appear to be the future
We just have to survive until we get there