Asian Citrus Psyllid and Huanglongbing

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Overview

- Introduction to pest and pathogen
- Indication of California situation
- Industry, State and federal responses to HLB threat

Asian Citrus Psyllid (*Diaphorina citri*) and HLB (*Candidatus Liberibacter asiaticus*)

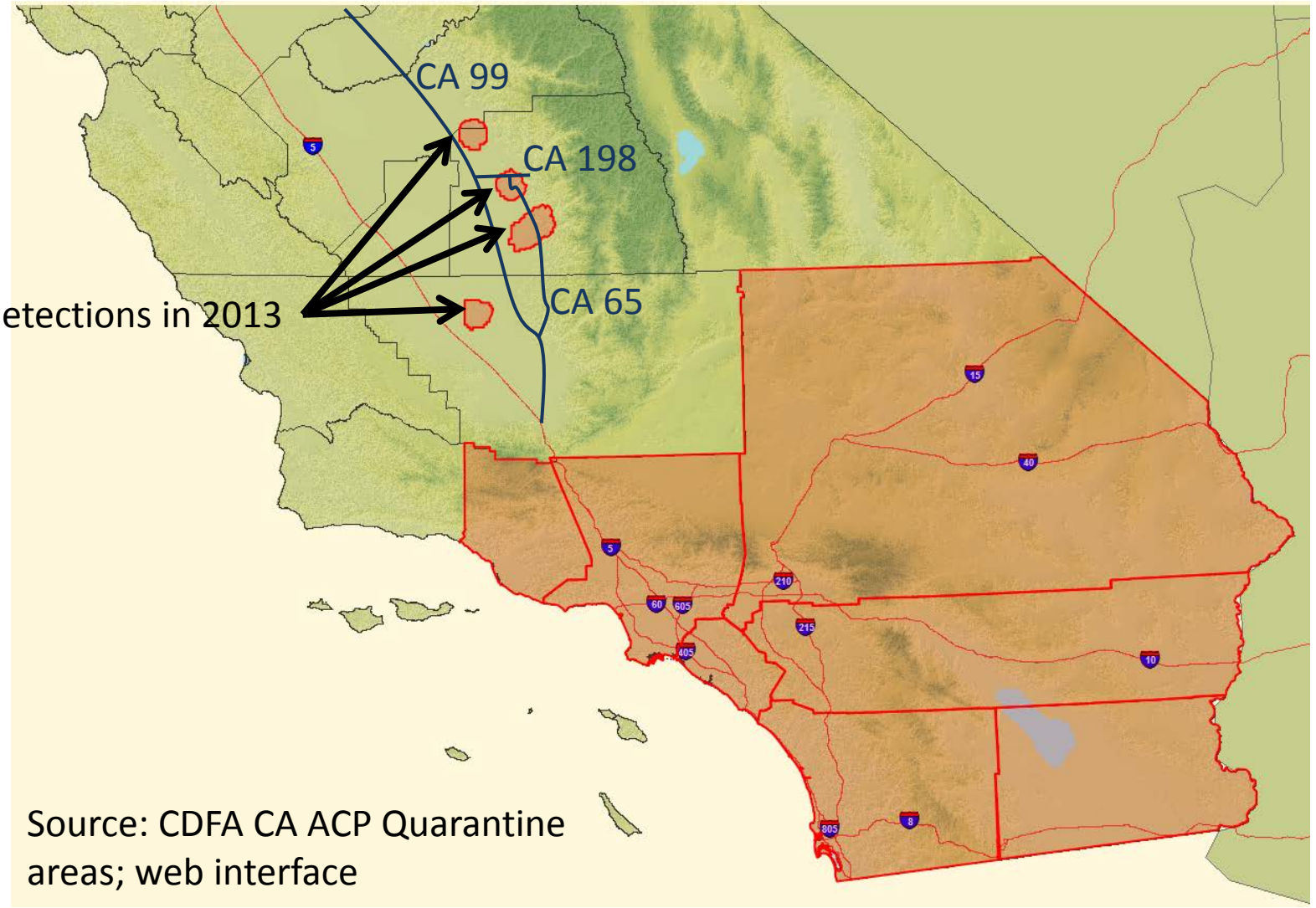
http://californiacitrusthreat.org/

ACP/HLB situation in California

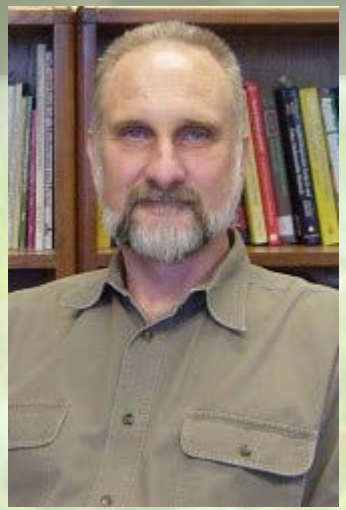
http://www.cdfa.ca.gov/plant/acp/index.html

- ACP first discovered in 2008
- Now widespread in much of southern California
- In 2013 ACP detections in southern San Joaquin Valley became more frequent
- To date only 1 confirmed case of HLB: tree in residential neighborhood of greater LA.

Incursion of ACP into the San Joaquin Valley



IRCHLB III: Risk-based Residential HLB/ACP Survey for California, Texas, and Arizona



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Purpose of a CA Residential Survey

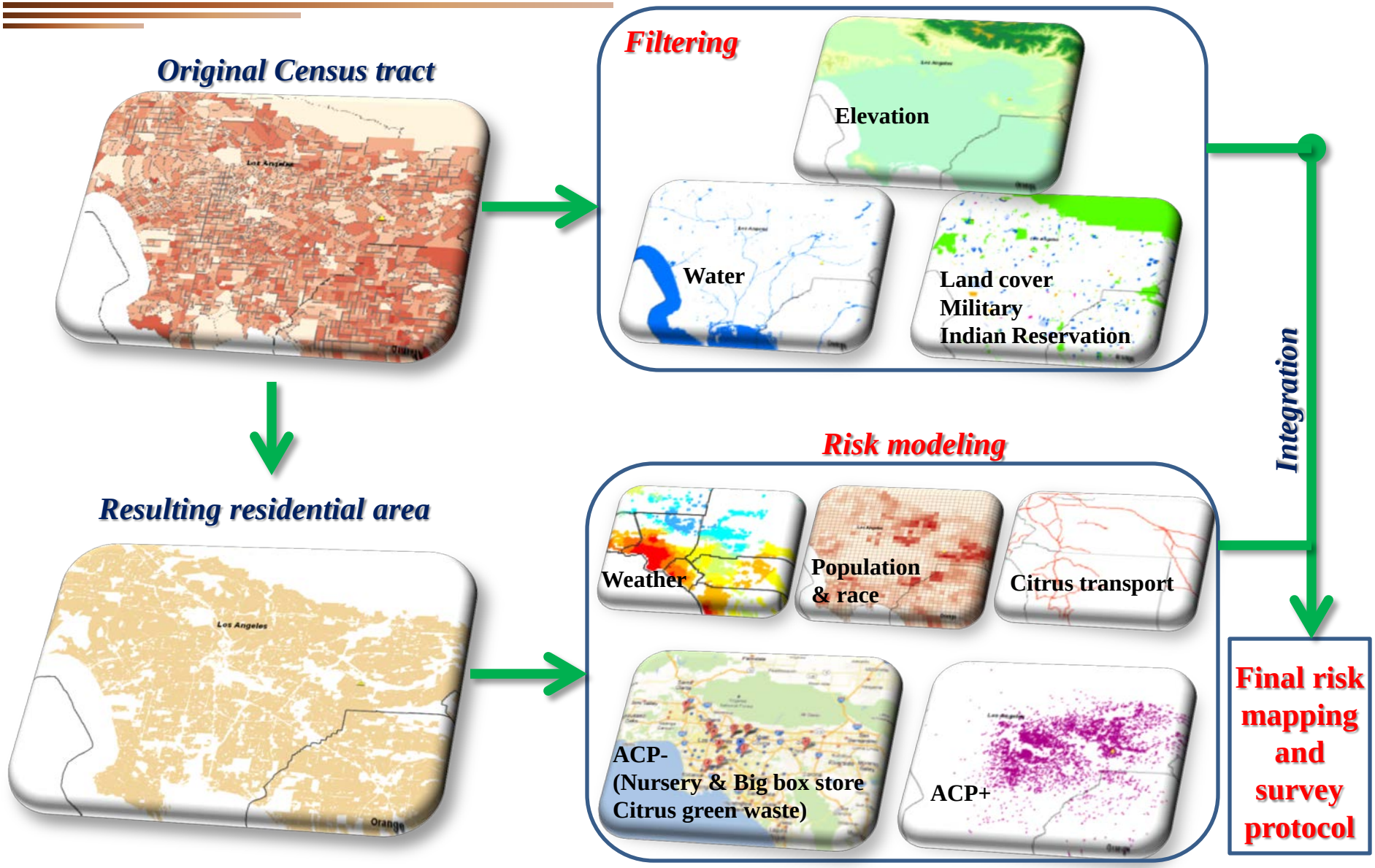
Justification:

- Early detection of HLB to:
  - Maximize regulatory intervention and disease control.
  - Minimize disease incidence, spread, and impact to commercial citrus industry.
- The recent finds of HLB underscore the urgency
  - Los Angeles basin (residential)
  - Texas (Commercial planting)

Requisites and Goals:

- A statistically accurate and justifiable survey protocol to be used pre- and post-discovery - for early detection across all citrus industries within the US that:
  - Incorporates all HLB/ACP biological and epidemiological factors.
  - Can be applied across residential areas and commercial citrus.
  - Has high probability for early detection of both HLB and ACP.
  - Maximizes targeting of control/mitigation efforts.
  - Maximizes fiscal and manpower resources.

Model framework



2. Risk Modeling

Determining risk variables and their effects

Formula & algorithm

Estimate total risk in residential area, including:

1. Residential citrus population and distribution
2. Residential Asian population risk
3. ACP+ location risk
4. Citrus production related transport corridors
5. Potential ACP spread risk from commercial nursery , green waste facility, military installation, packing house and flea market
6. Distance to Mexico-TX border crossing
7. HLB and ACP -- LAS+ locations risk
8. Proximity to commercial citrus groves (adjustment for sampling intensity)

Potential HLB risk (items 2–6)

Known HLB risk (item 7)

Output variables

Residential citrus:	Pop_{citrus}
Residential Asian risk:	R_{Asian}
ACP+ risk:	R_{ACP+}
Transportation risk:	R_{Road}
Potential ACP risk:	R_{ACP-}
LAS+ risk	R_{LAS}
Border crossing risk:	R_{Border}

No prior preference for each risk factor, so equal weight is applied.
The suitable weighting to be determined later from survey results.

Total risk= Residential citrus *{([Asian] + [ACP+] + [Road]+ [ACP-]+[Border])/5+[LAS+]}

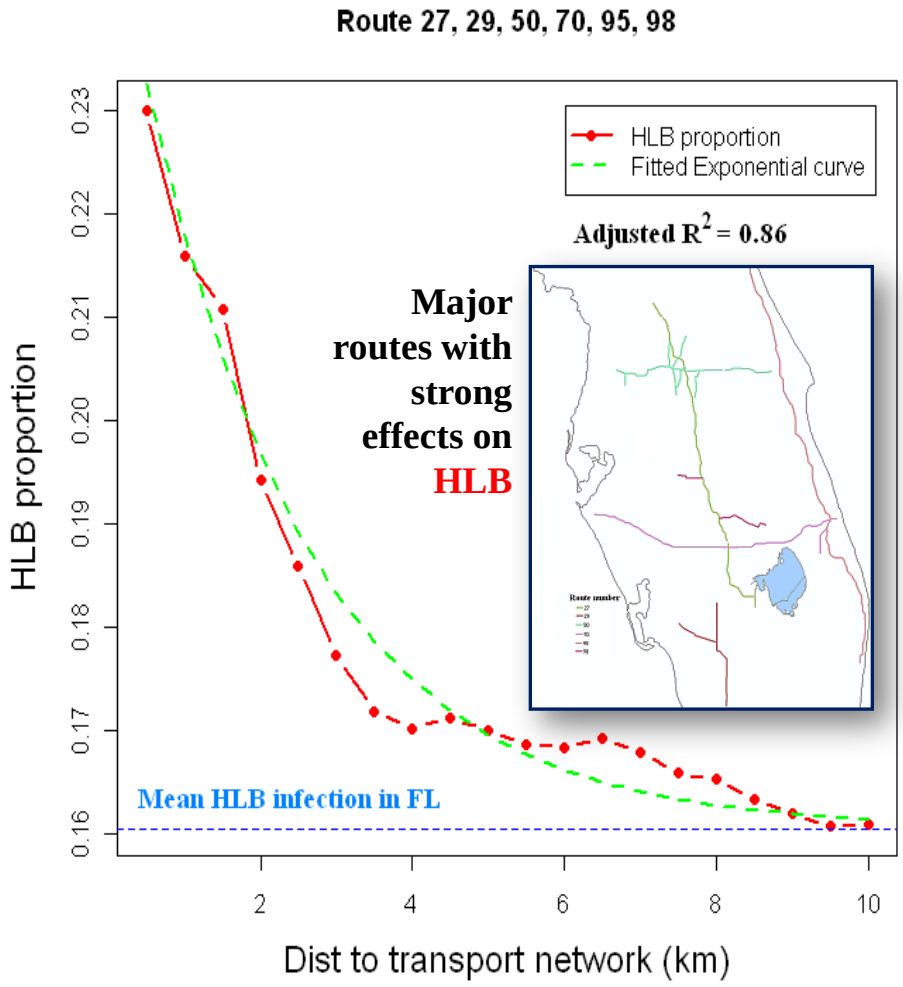
$$= \log(Pop_{citrus}) * \left\{ \frac{(R_{Asian} + R_{ACP+} + R_{Road} + R_{ACP-} + R_{Border})}{5} + R_{LAS} \right\}$$

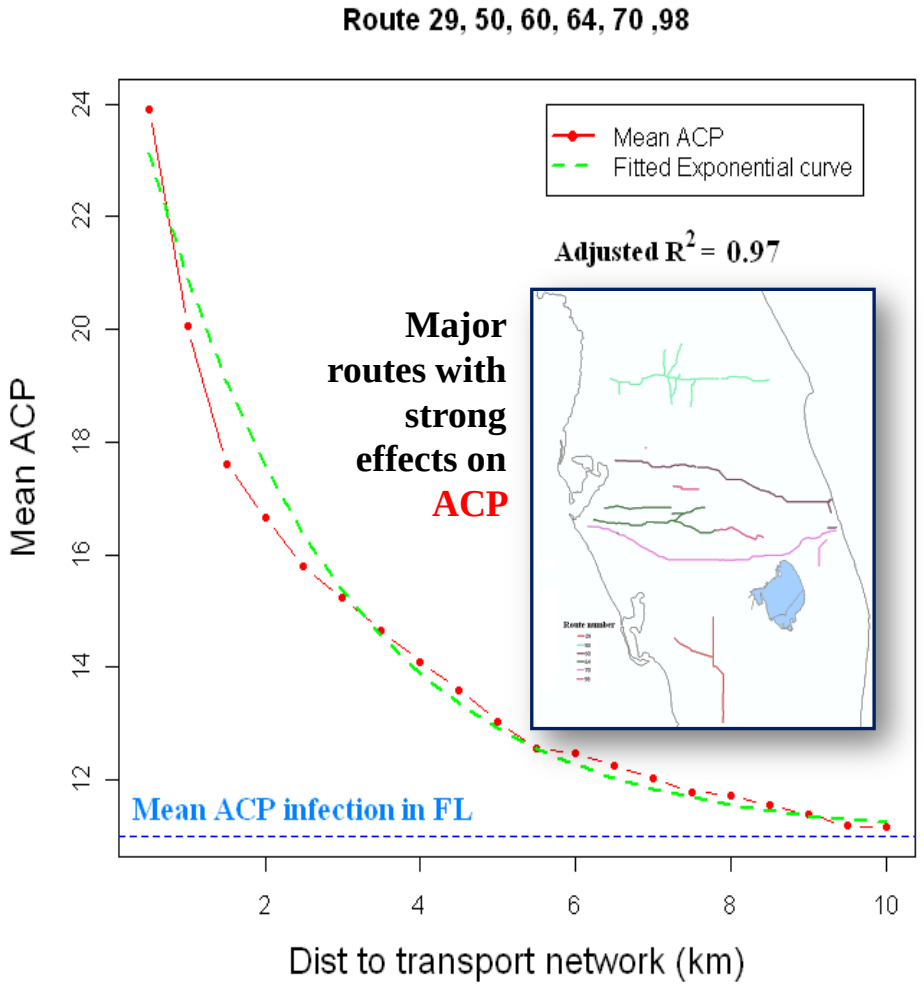
Total risk → (Proximity to commercial citrus groves) → **Sampling intensity**

Formula & algorithm

4. Estimate risk from citrus fruit transport corridor (to packinghouse and juice plants)

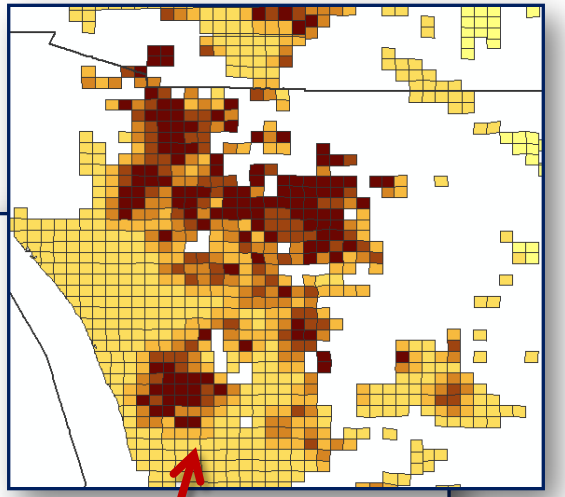
- **Apply HLB/ACP spread curve determined from Florida data**



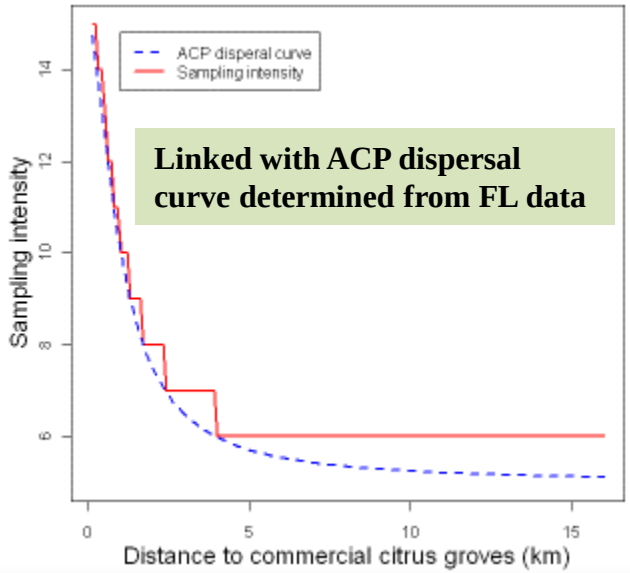


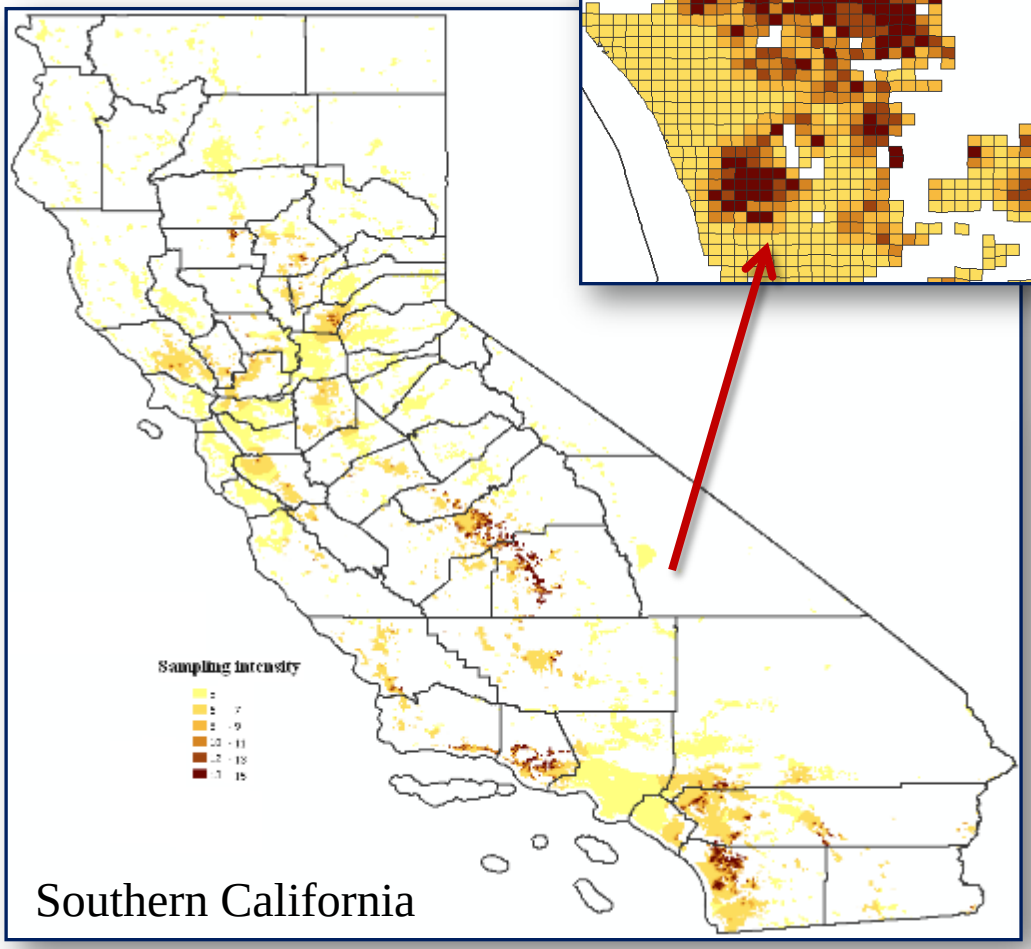
Full information available: Gottwald & Luo, An investigation of transport network on HLB/ACP spread.

Distance to commercial citrus groves
Not ‘Risk’ but *affects sampling intensity*

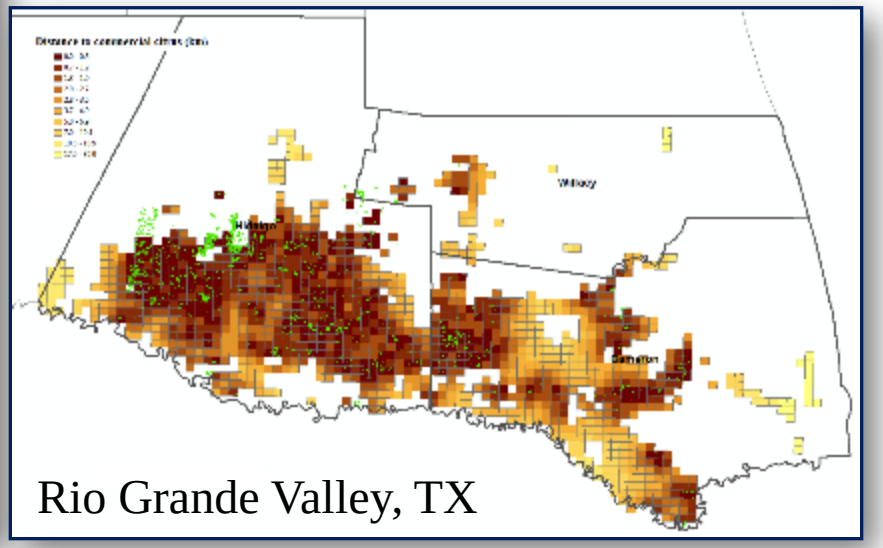


Proposed new sampling scheme





Southern California

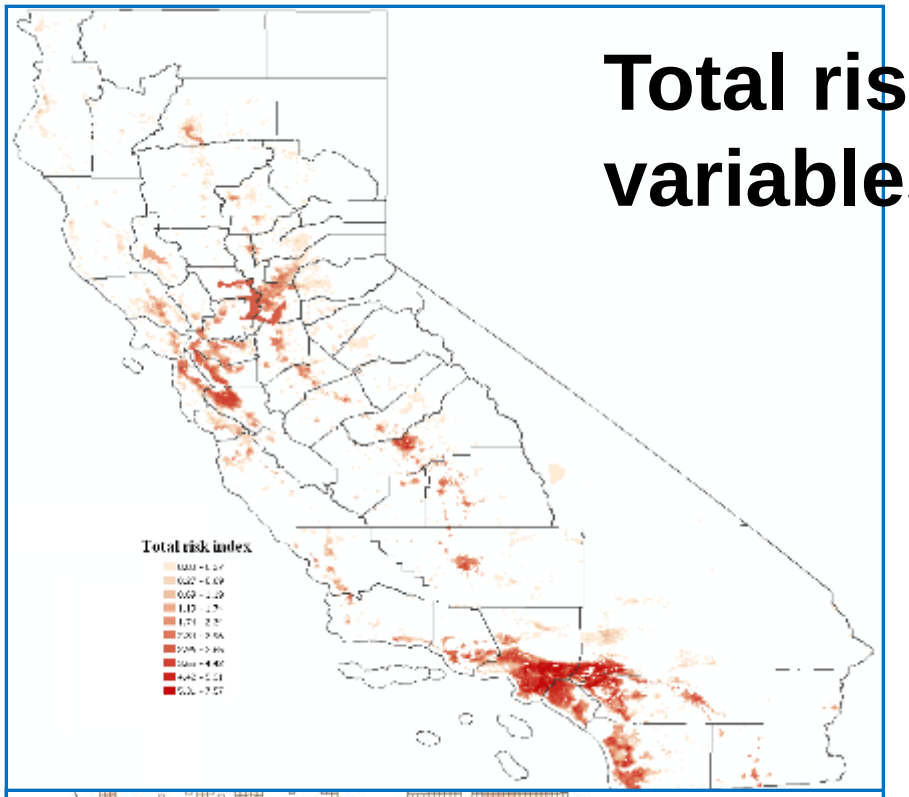


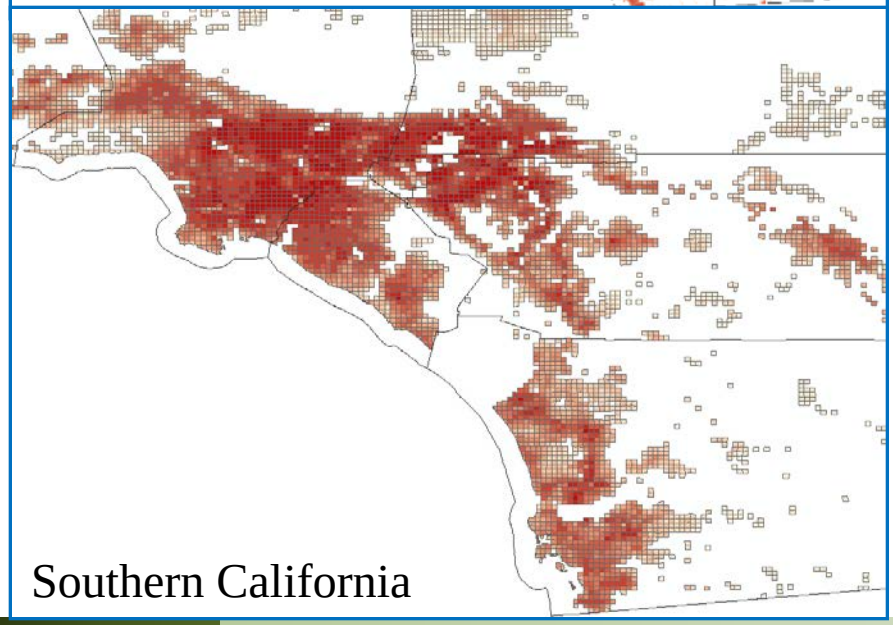
Rio Grande Valley, TX

3. Risk Mapping

Integrating filtering and risk variables with GIS data to develop survey design and intensity

Total risk map (Considers all variables and filtering)





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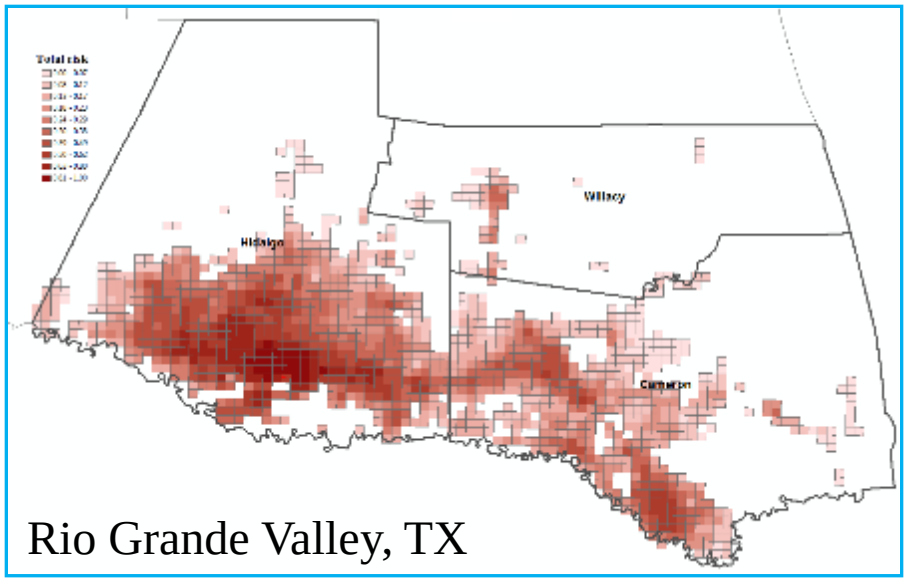
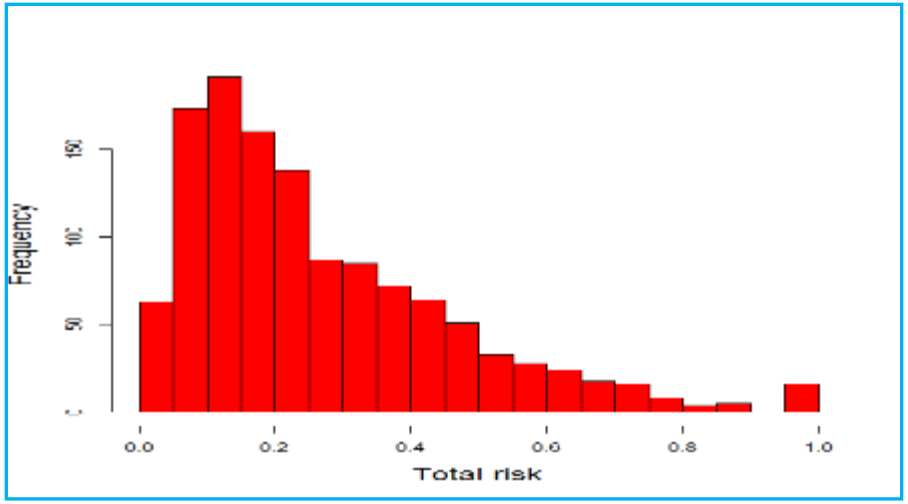
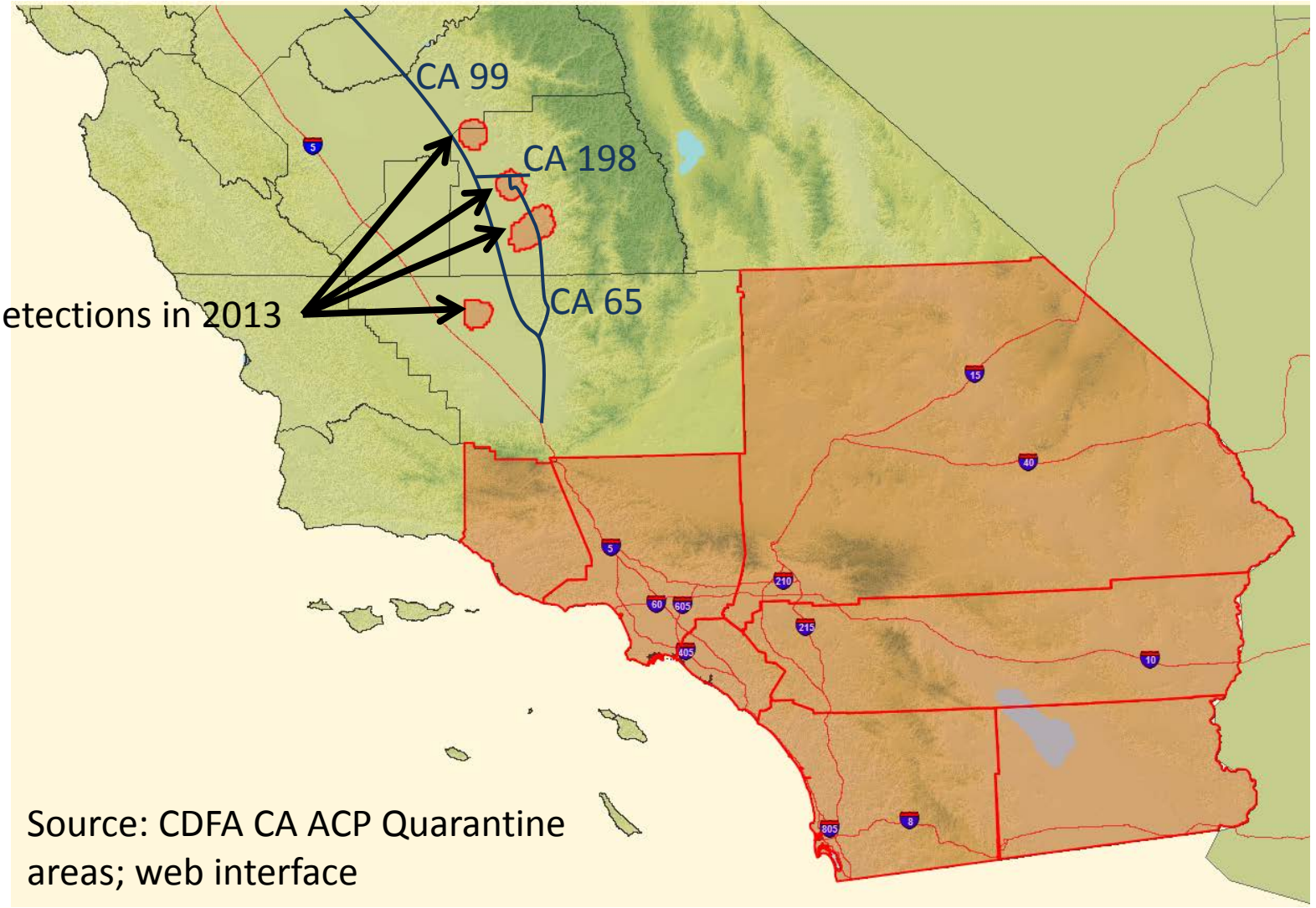


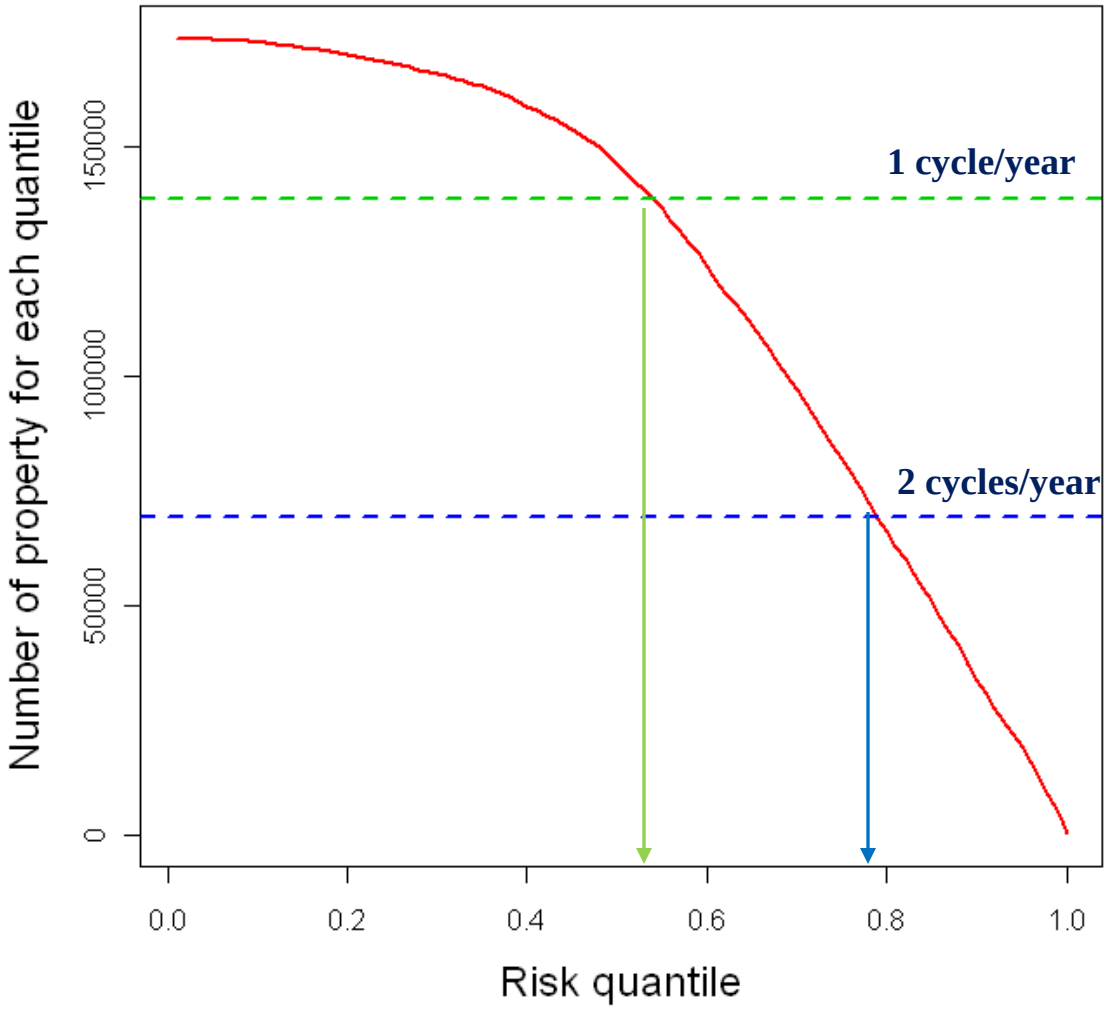
Rio Grande Valley, TX

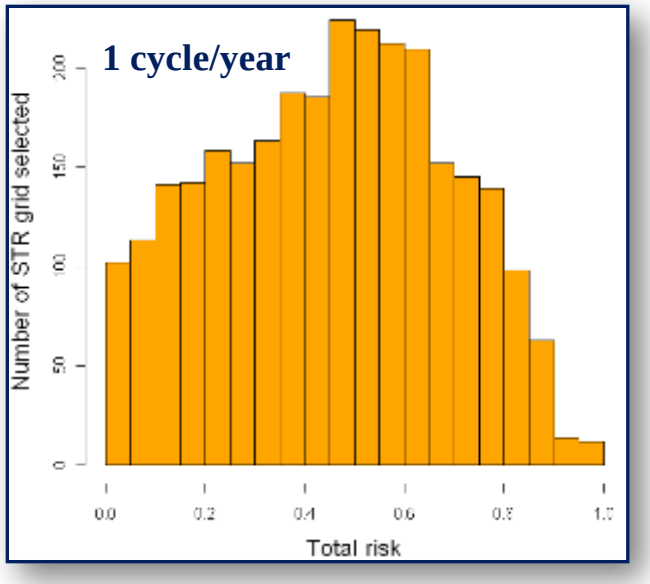


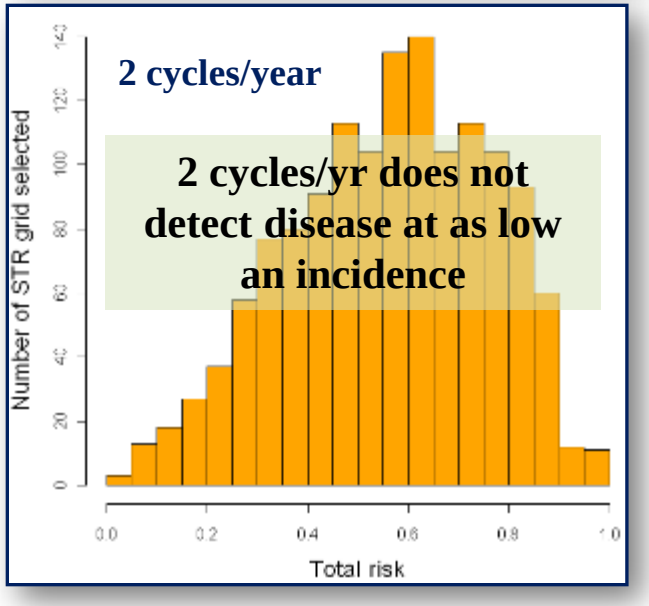
Incursion of ACP into the San Joaquin Valley



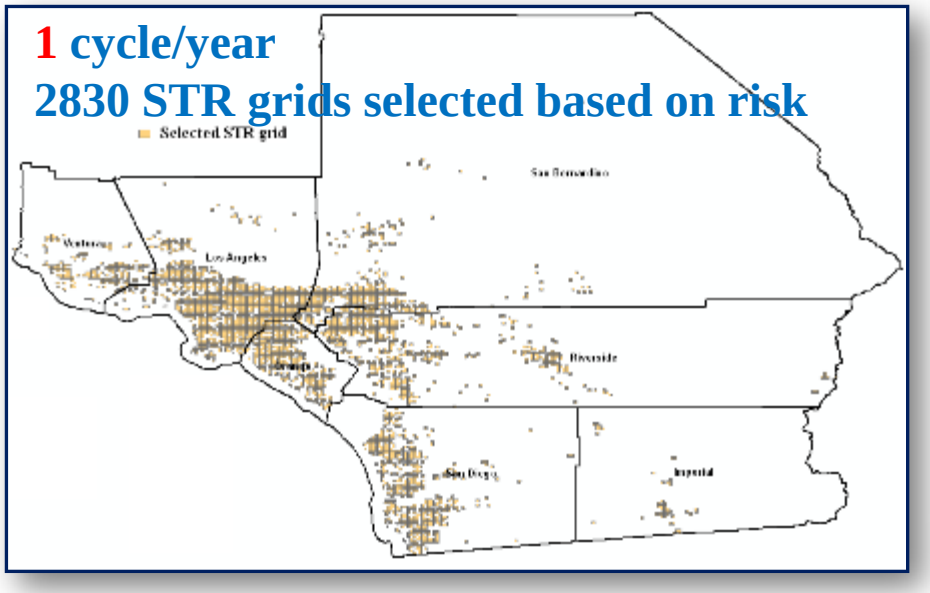
Manpower and number of survey cycles/year

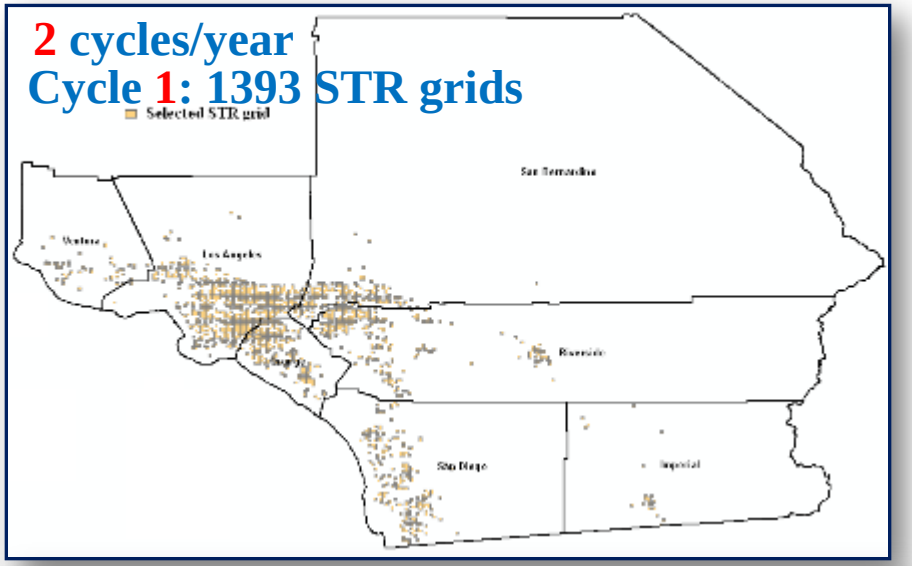


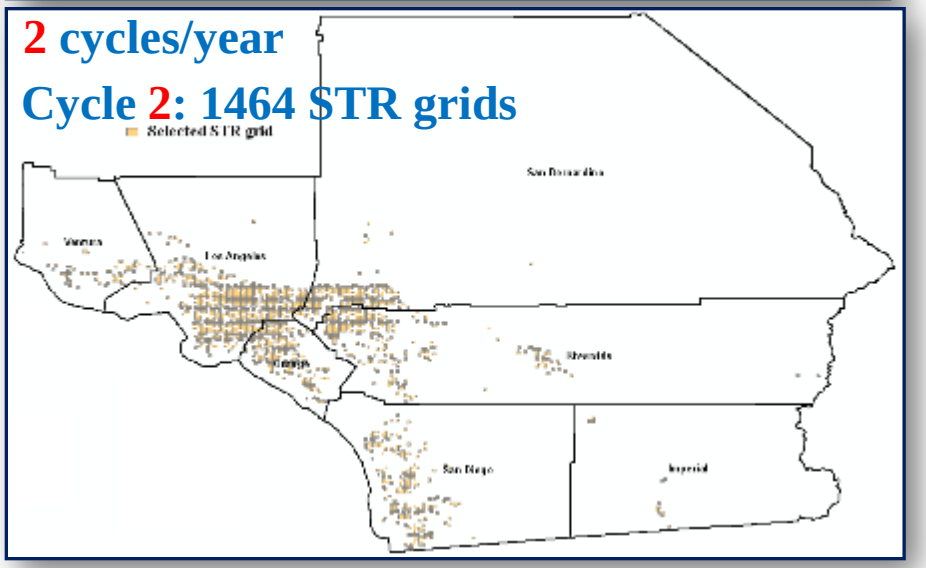




Risk-based sampling (1or 2 cycles/year)







Extra assurance = Includes random selection of a small proportion of low risk STR areas.
In case we are totally wrong!!!!

For more information on risk assessment

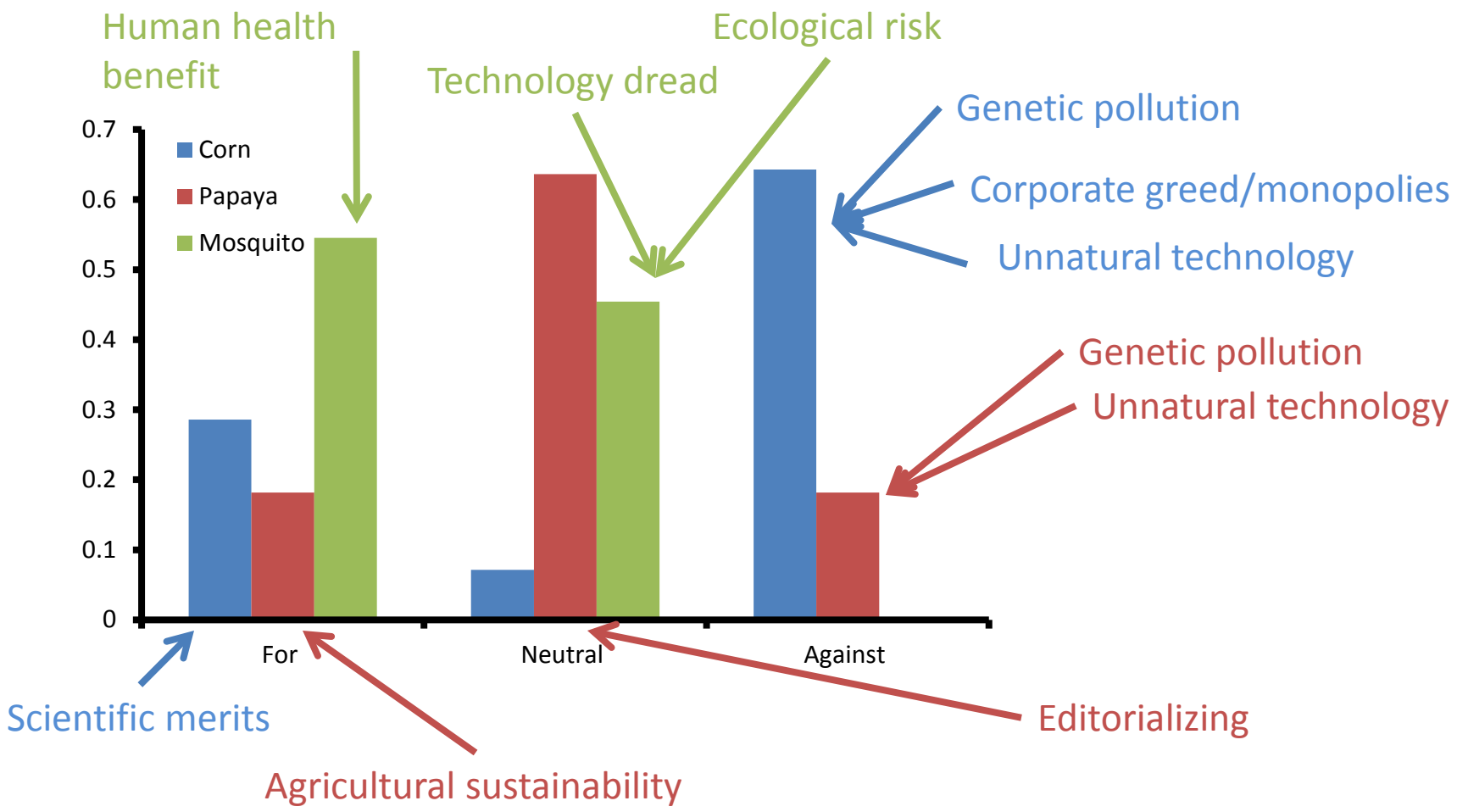
A webcast by Dr Gottwald describing the process of building and deploying the risk model, mapping, and survey protocols is available at:

http://www.plantmanagementnetwork.org/edcenter/seminars/outreach/Citrus/HLB/

Medium to long-term solutions

- Organize growers into neighborhood (area-wide) response groups (learn from unfortunate FL experience).
- Breed and release an altered Psyllid which is not competent as a vector for Clas.
  - Subject of $15M USDA/Industry CAP grant

Where would νPsyllid sit in the spectrum of opinion about GM traits?



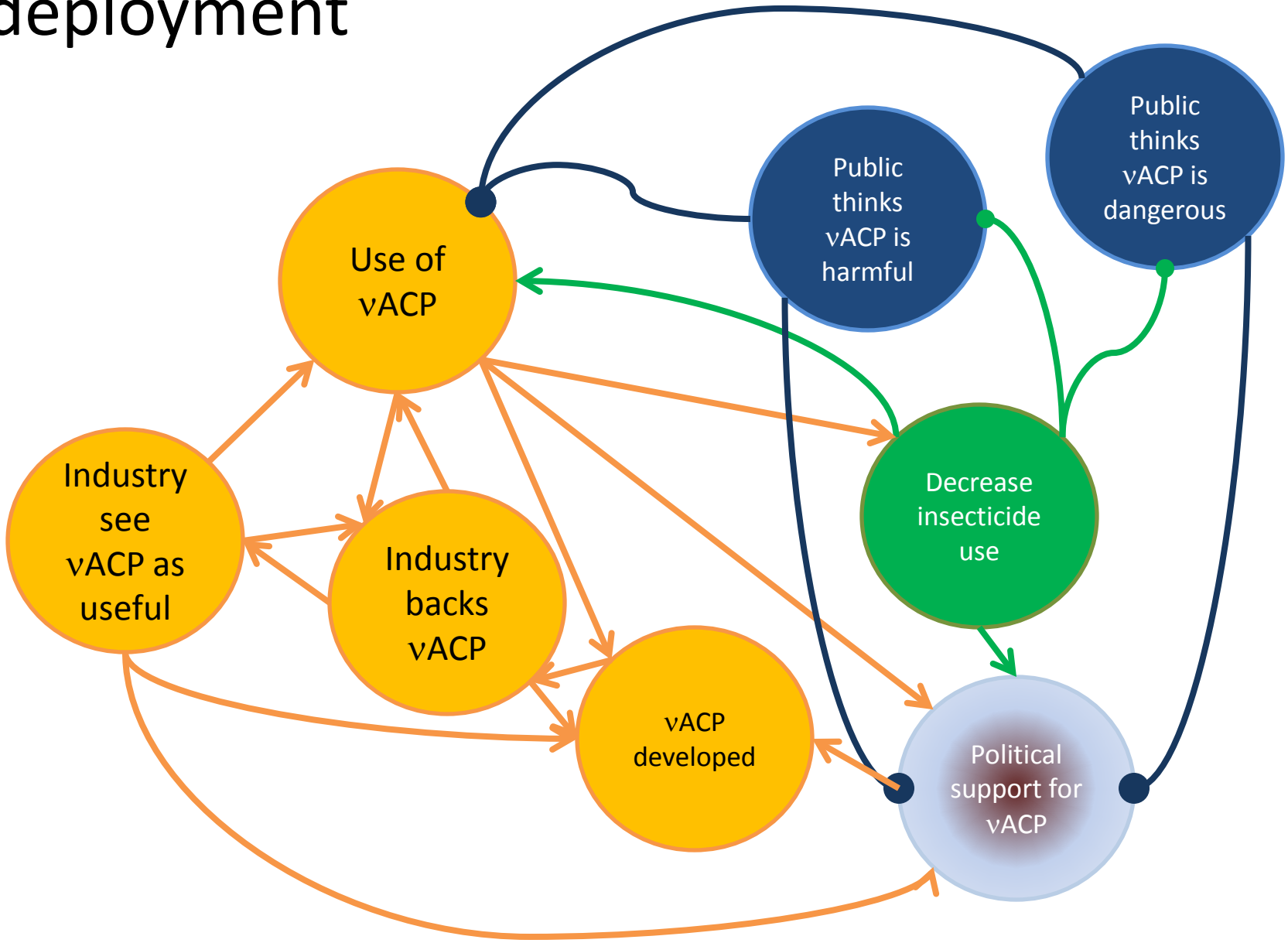
Division of Google ranked pages on page 1 of searches for “GM corn”, “GM papaya” and “GM mosquito”.

Crossing the Rubicon

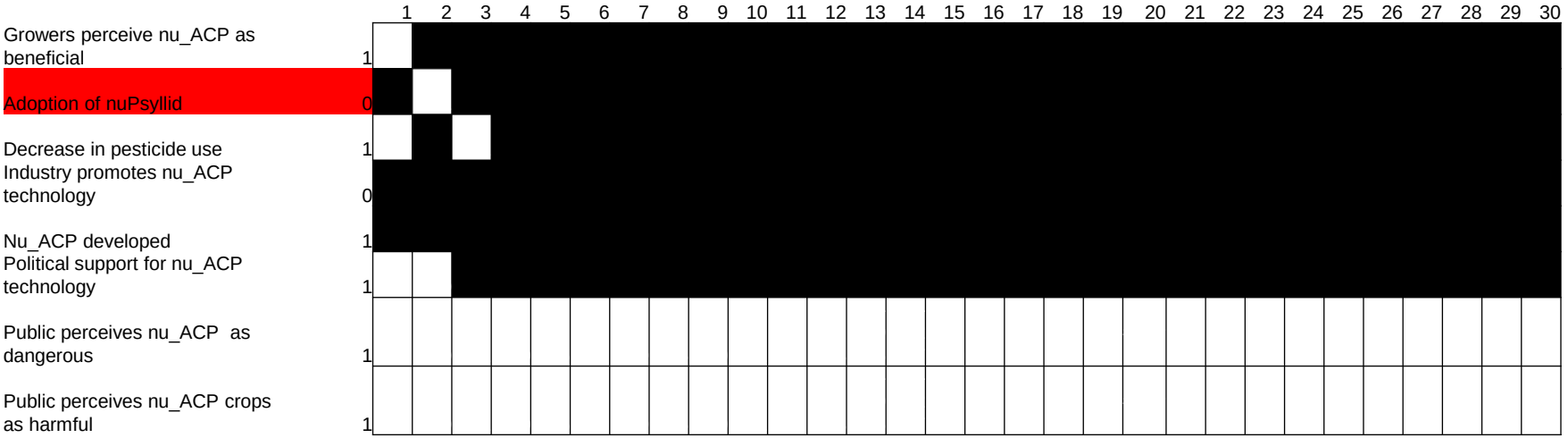
Adopting a biotech solution moves the industry to a qualitatively different place in public perception

Does it have to?

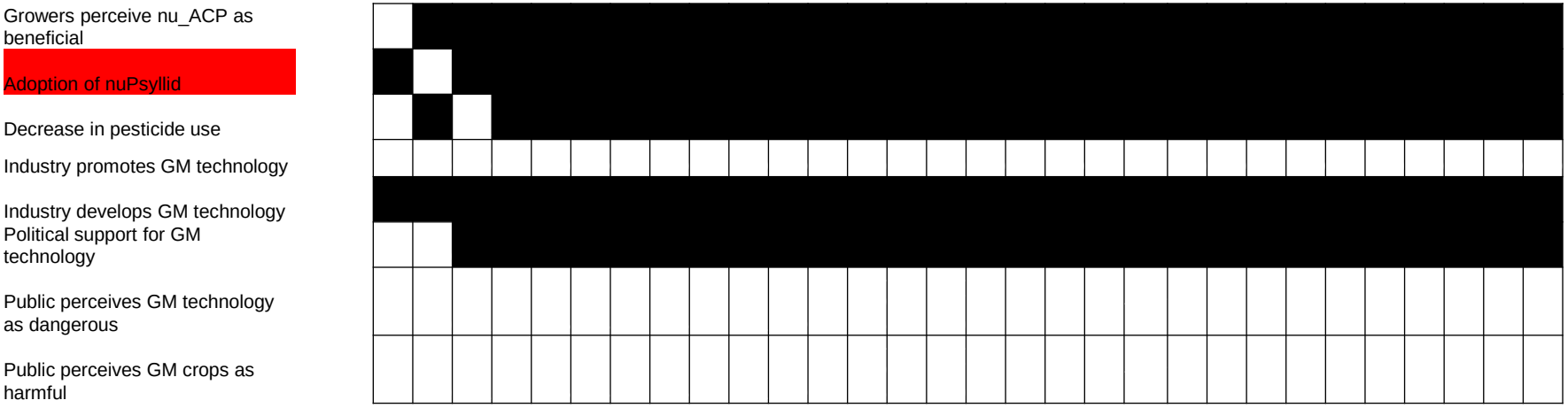
Simple causal model: a first look at νPsyllid deployment



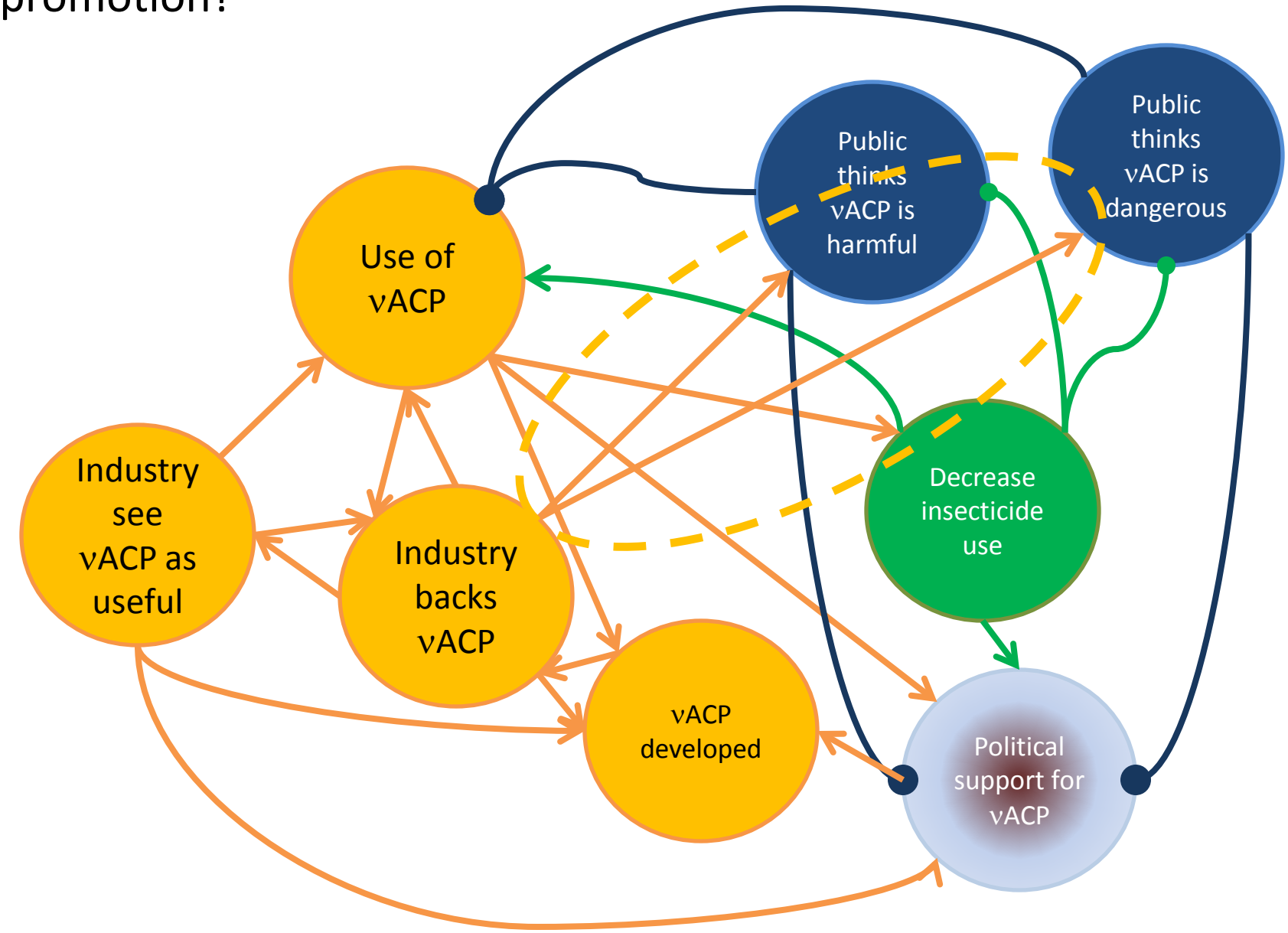
Demonstrating benefit and avoiding antagonism could lead to sustainable $_{\nu}$Psyllid use



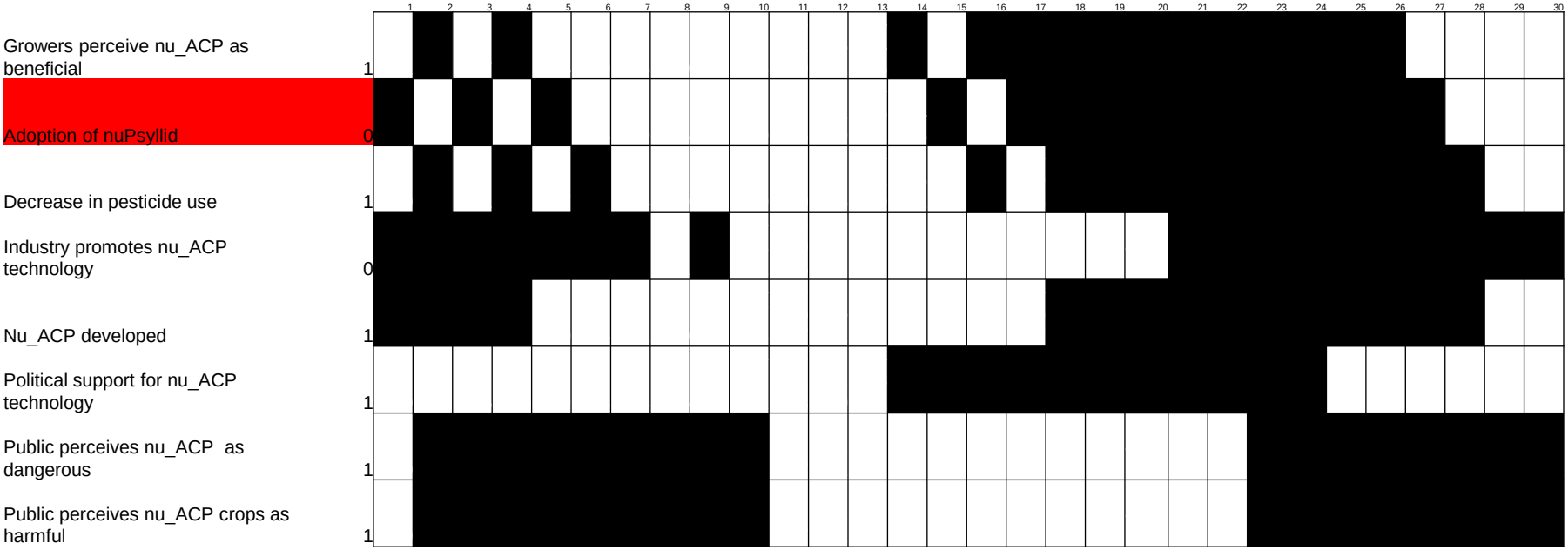
It may even be possible at low direct cost to the industry



What happens if public opinion is strengthened by industry promotion?



With feedback between industry PR and public opinion things get messy



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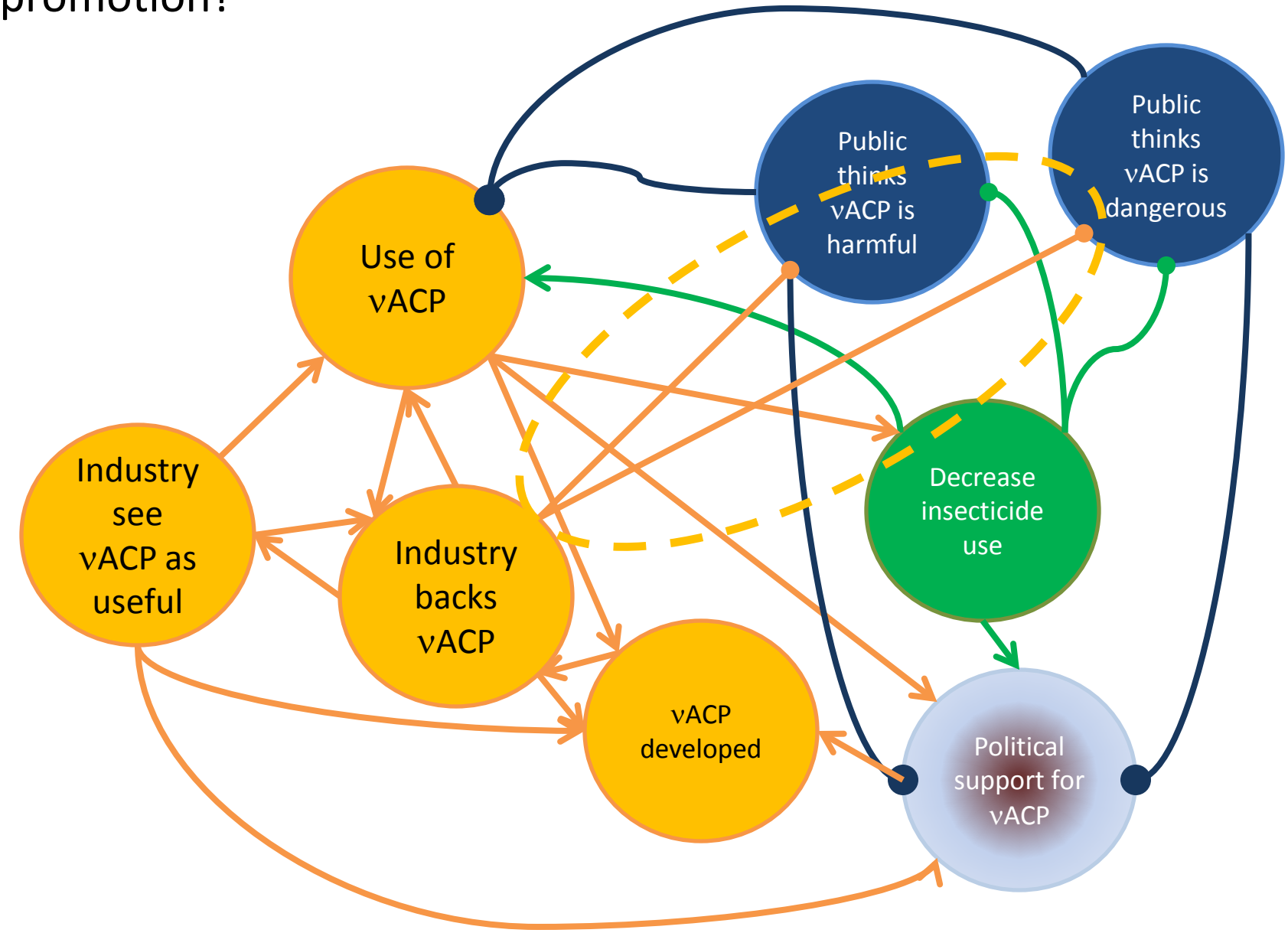


With negative feedback between industry PR and skeptical public opinion there is hope

Growers perceive nu_ACP as beneficial

Adoption of nuPsyllid

Decrease in pesticide use

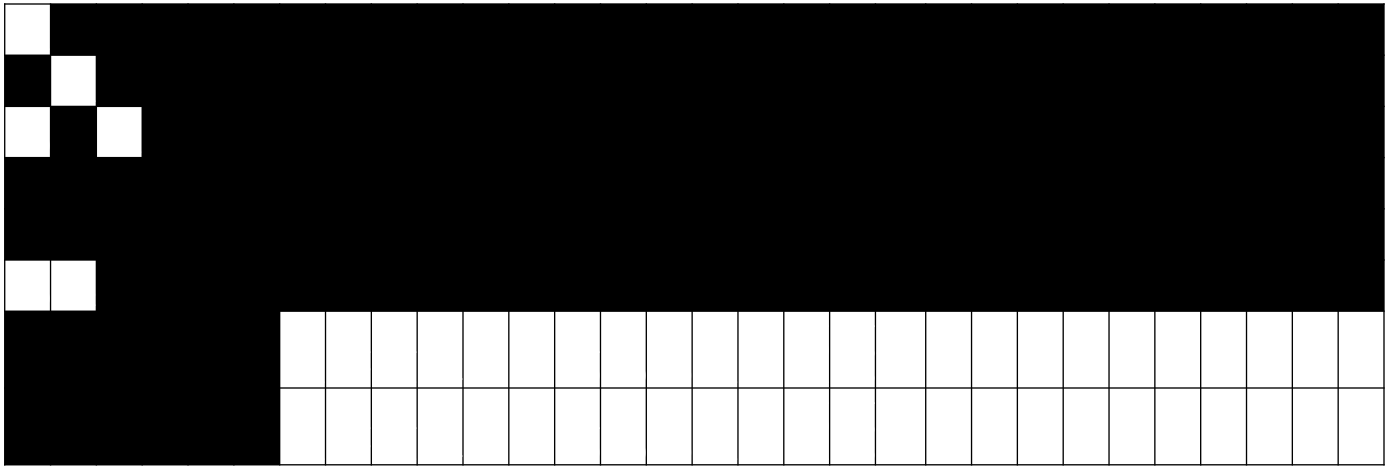
Industry promotes GM technology

Industry develops GM technology

Political support for GM technology

Public perceives GM technology as dangerous

Public perceives GM crops as harmful



Acknowledgements

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