IPM Building Blocks to Control Invasive Shot Hole Borers - Fusarium Dieback

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Prioritizing Management of Introduced Invasive Pests

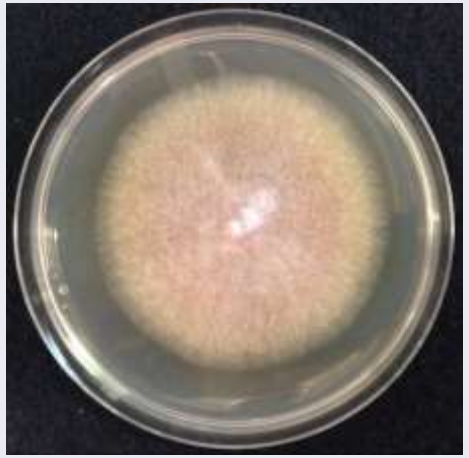
Fusarium Dieback: A Pest-Disease Complex

Euwallacea sp.

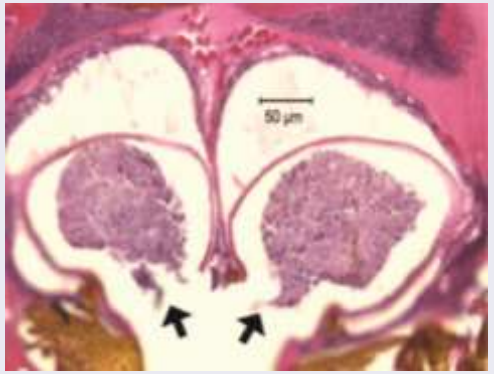
Polyphagous Shot Hole Borer
PSHB

Fusarium euwallaceae

Kuroshio Shot Hole Borer
KSHB



Fusarium kuroshium



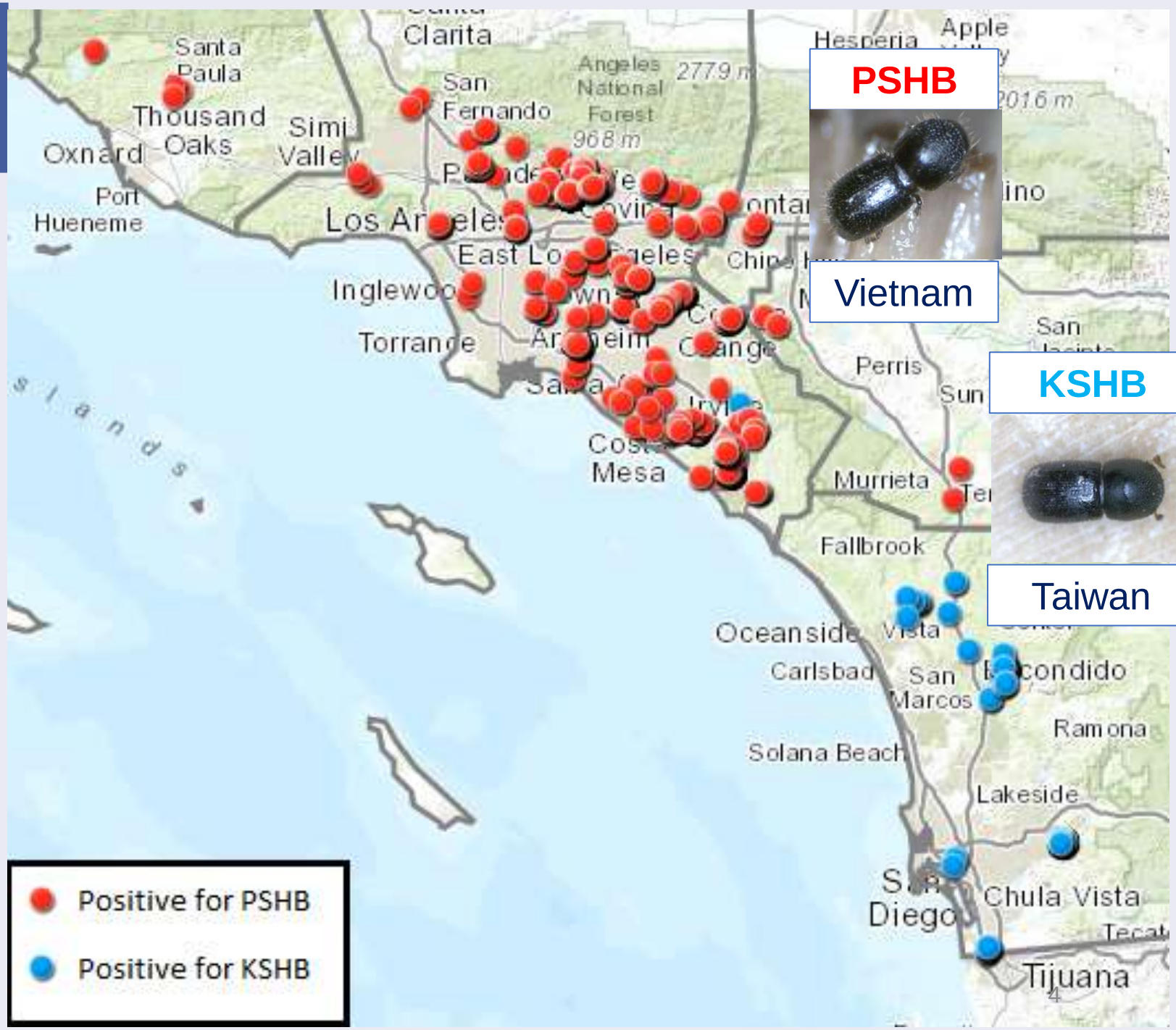
Mycangia

Figure: Matthew Kasson

Distribution

SHB

- PSHB: LA County 2012
- KSHB: SD County 2013



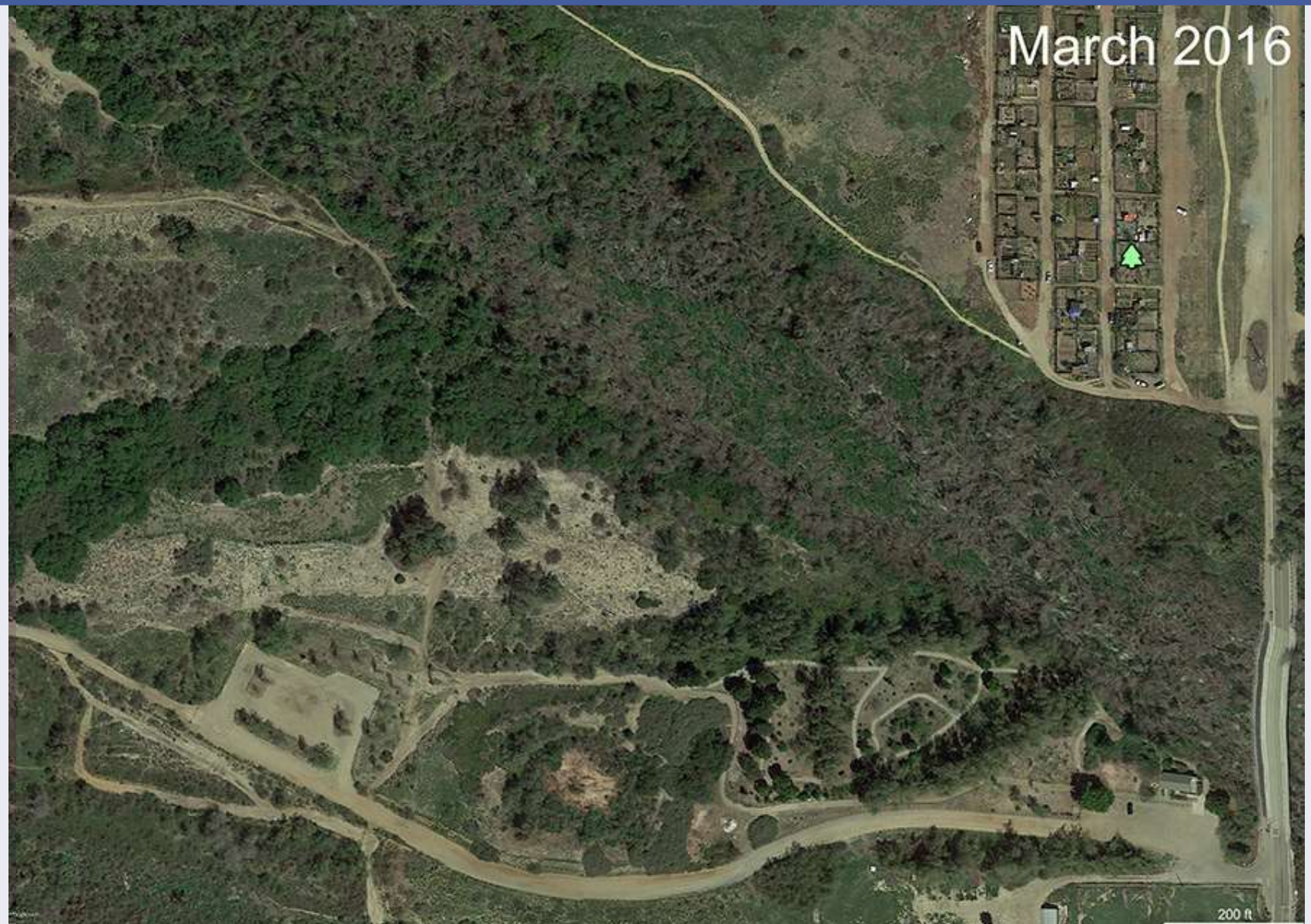
Fusarium Dieback: Disease Progress

Attack Progress on Fremont Cottonwood

Late Summer 2014

Photo: Tom Coleman

Fusarium Dieback Impacts in Tijuana River Valley



Fusarium Dieback Impacts in Tijuana River Valley

Willow Mortality: March 2016

Castor Bean Encroachment: Dec 2016

Photos: A.Eskalen

Implications for Endangered Wildlife Species

Least Bell’s vireo

www.allaboutbirds.org

Arroyo toad

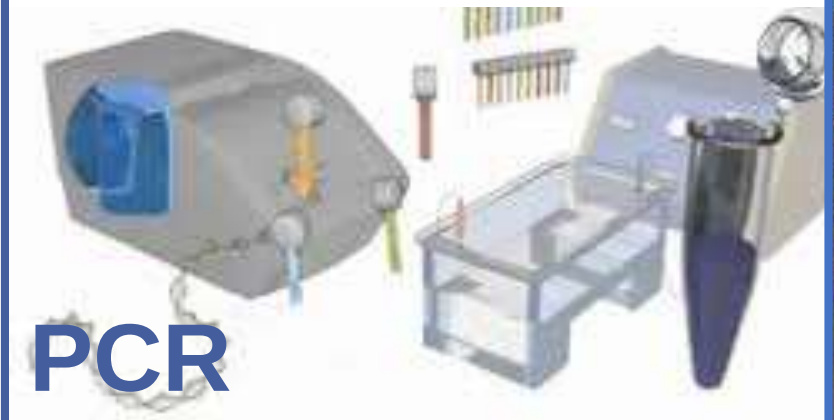
www.californiaherps.com

Southwestern willow flycatcher

www.nrcs.usda.gov

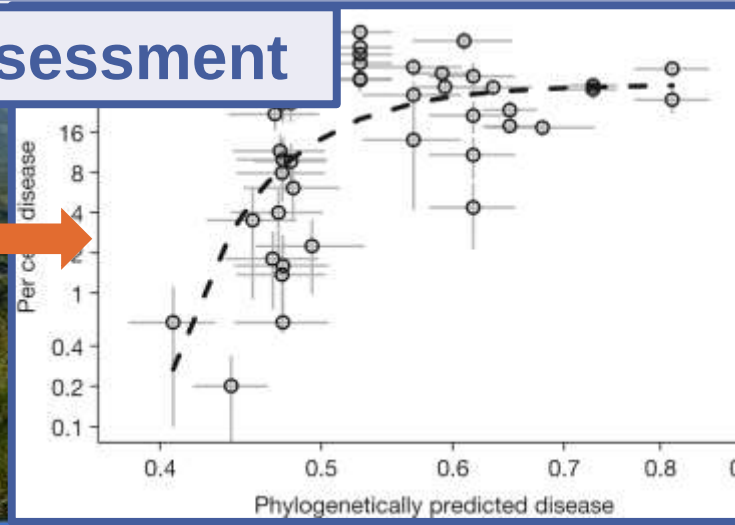
Integrative Pest Management Strategy

Early Detection Tools



PCR

Risk Assessment

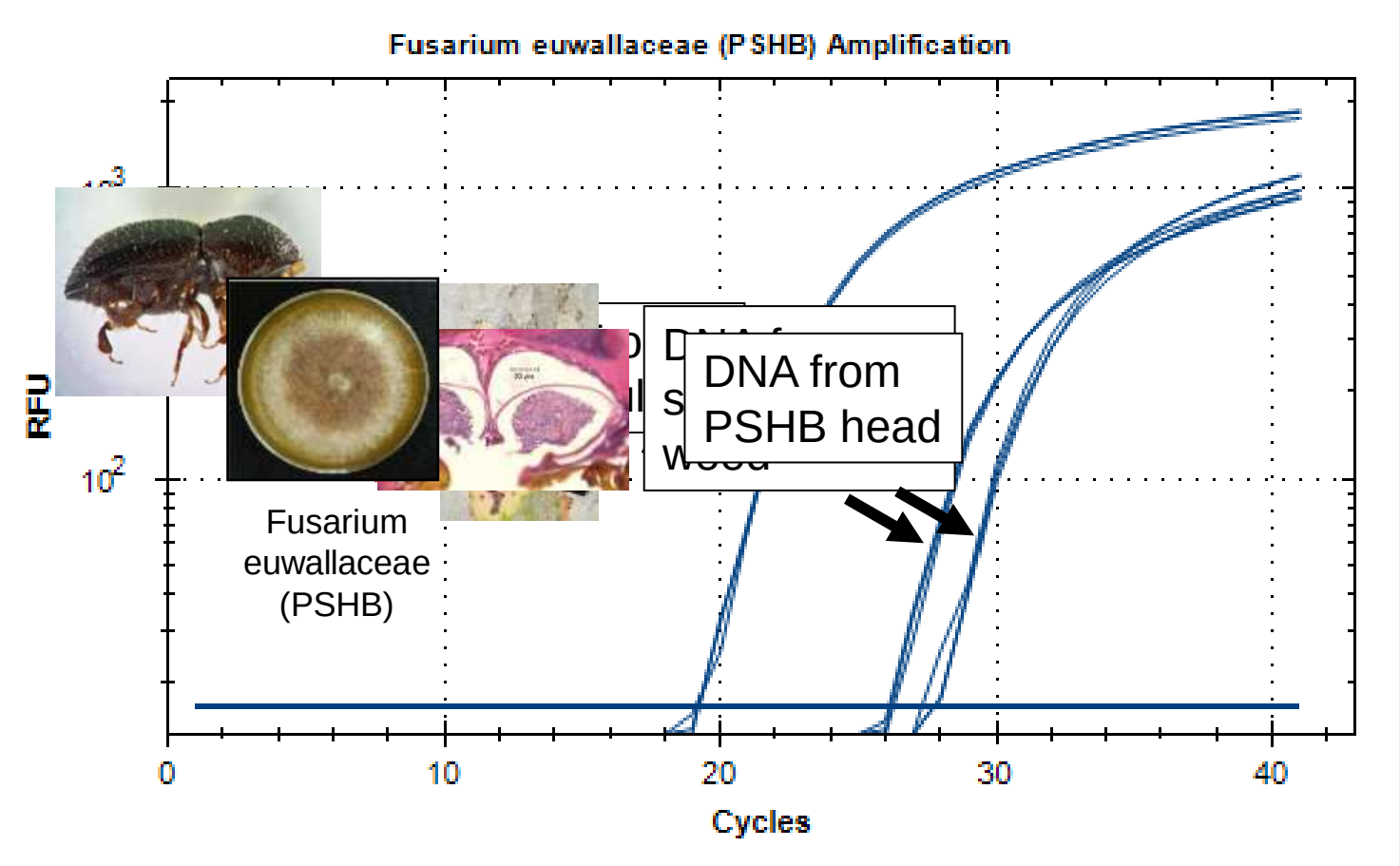


Treatments

Training

Evaluation

Early Detection Tools



Controls:

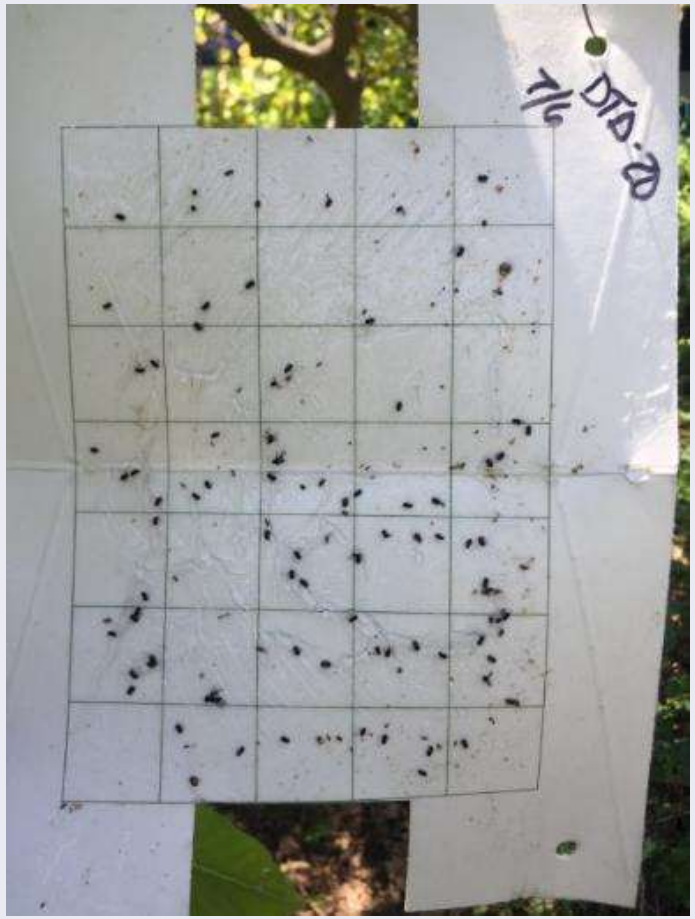
- Asymptomatic Wood (-)
- Fusarium solani (-)
- NTC (-)

Credit: Joseph Carillo Ph.D. Candidate UCR

Early Detection Tools

Lindgren Funnel Trap

Elm leaf beetle panel trap



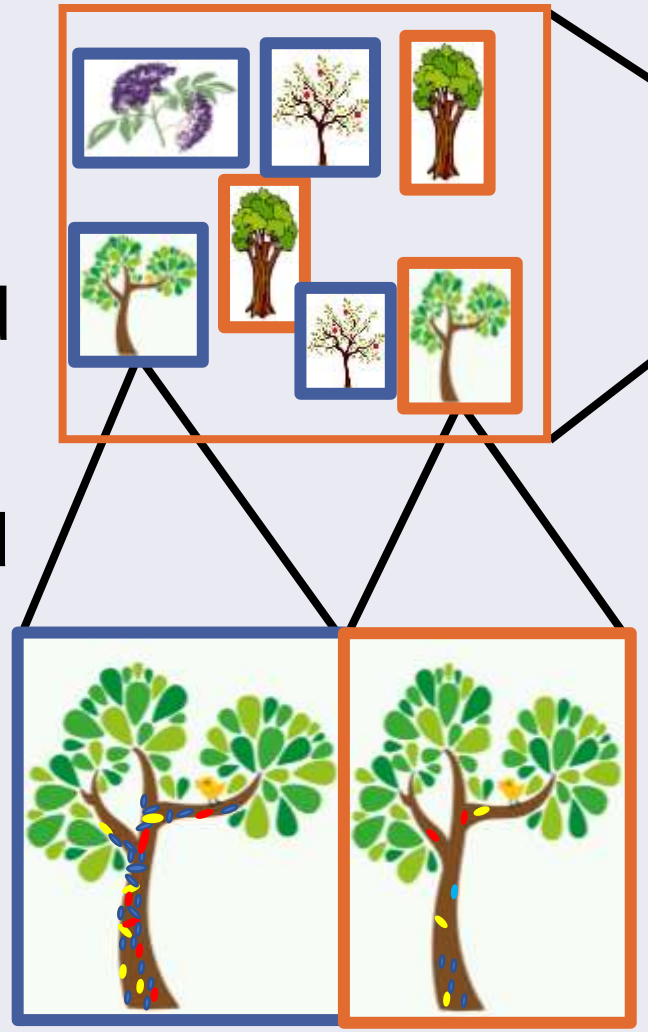
Lure: Querciverol

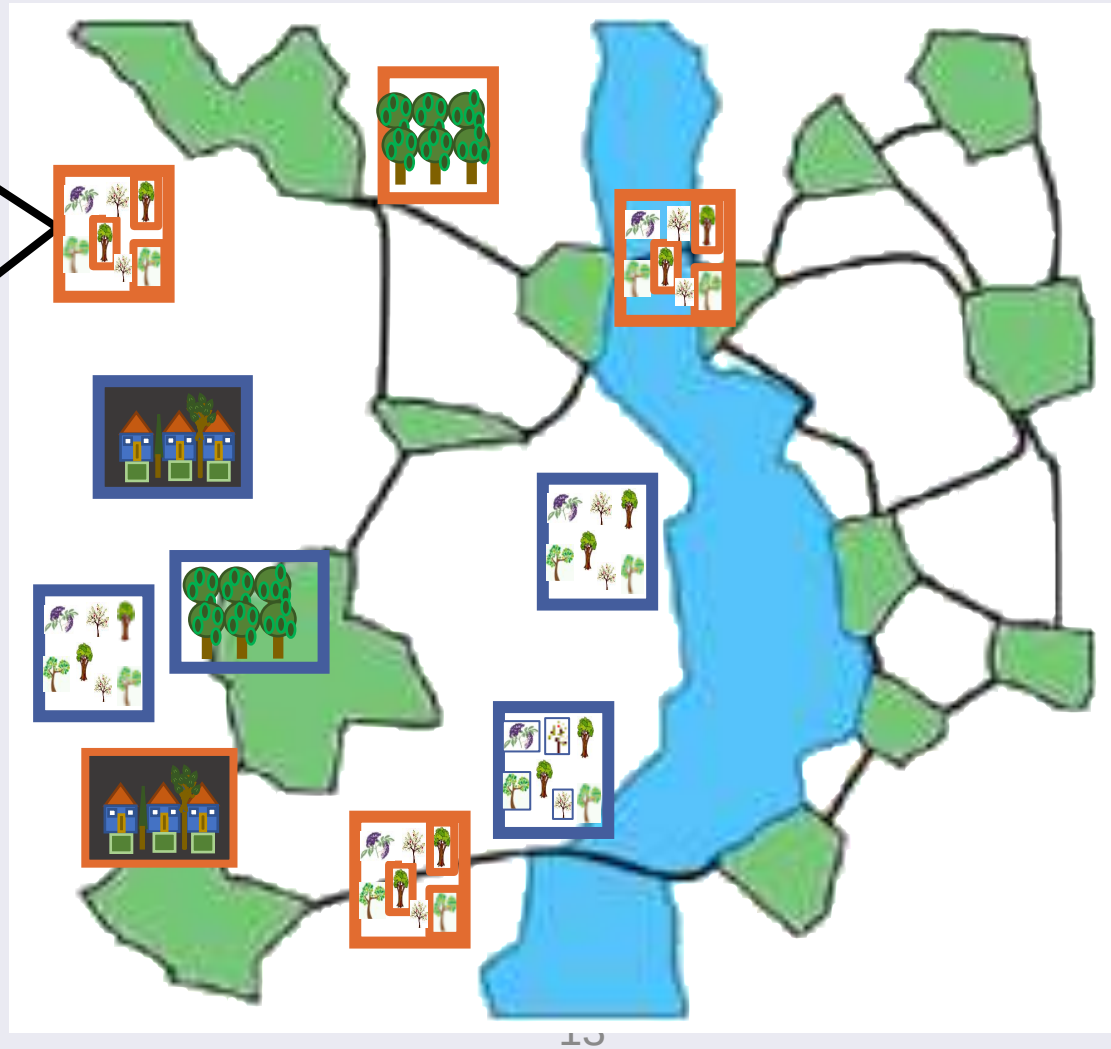
Photo | Richard Stouthamer, UC Riverside

Predicting Risk: Overview

Infested

Non-Infested

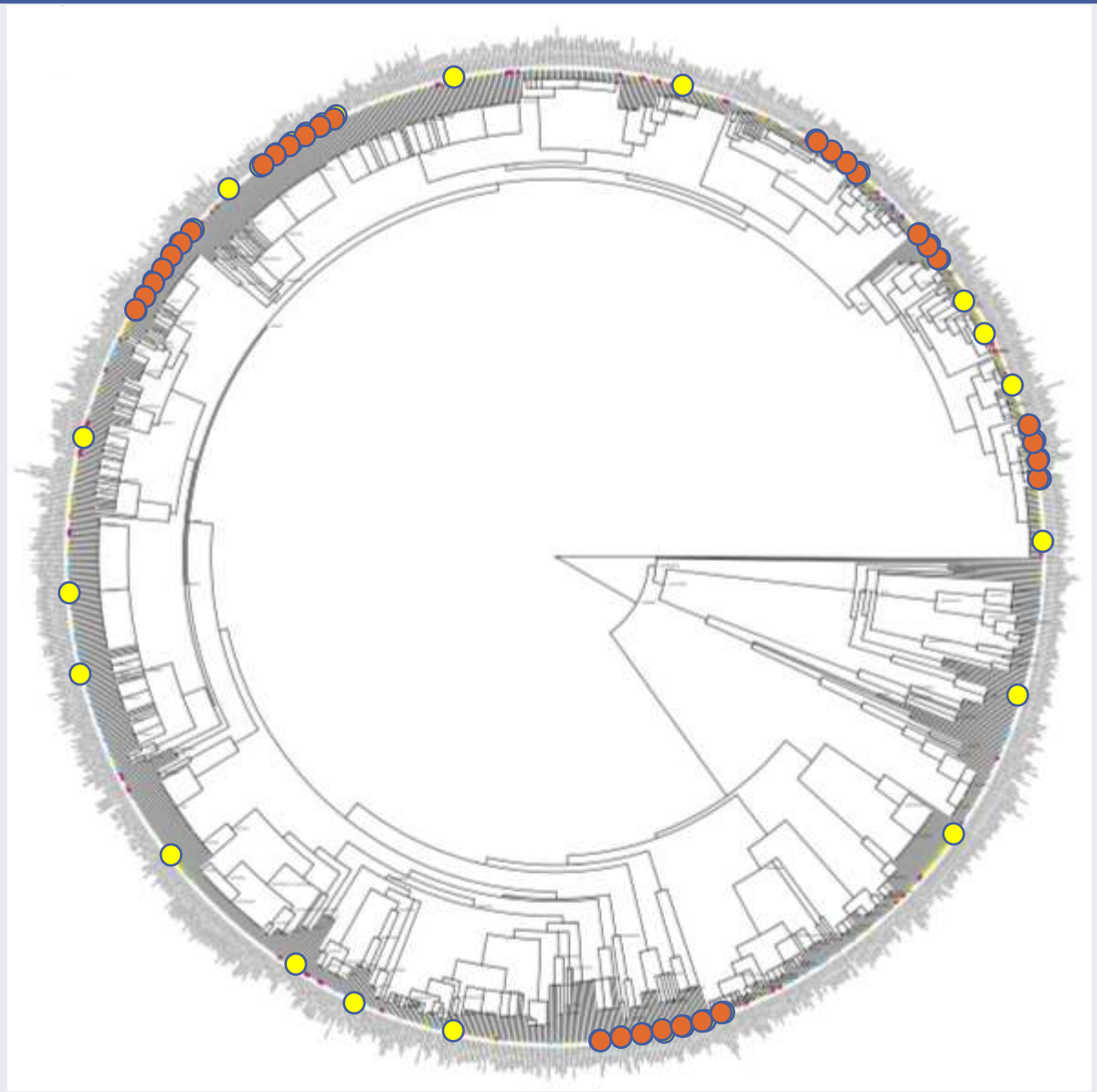


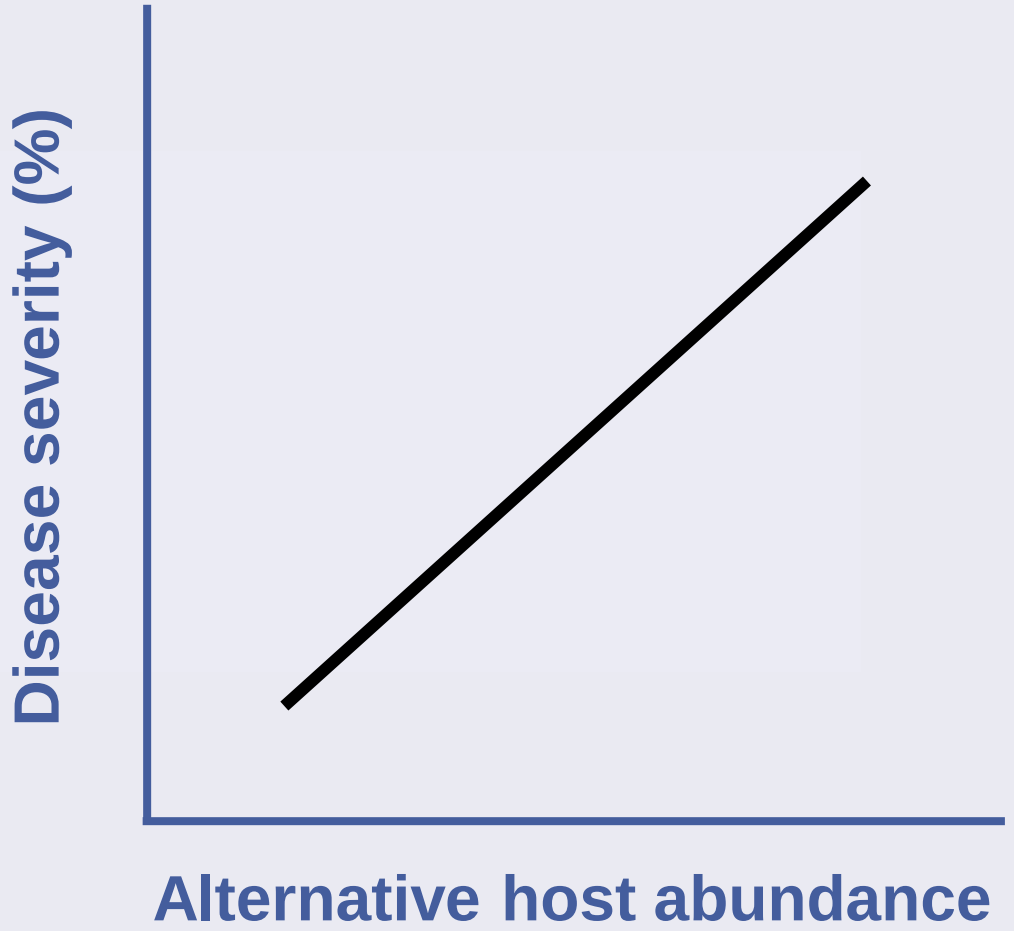


Fusarium dieback – shot hole borer Host Range

- 63 hosts support beetle reproduction
- Avocado
- 20 native to California
- Affected to varying degrees

Phylogenetic Signal in Reproductive Hosts



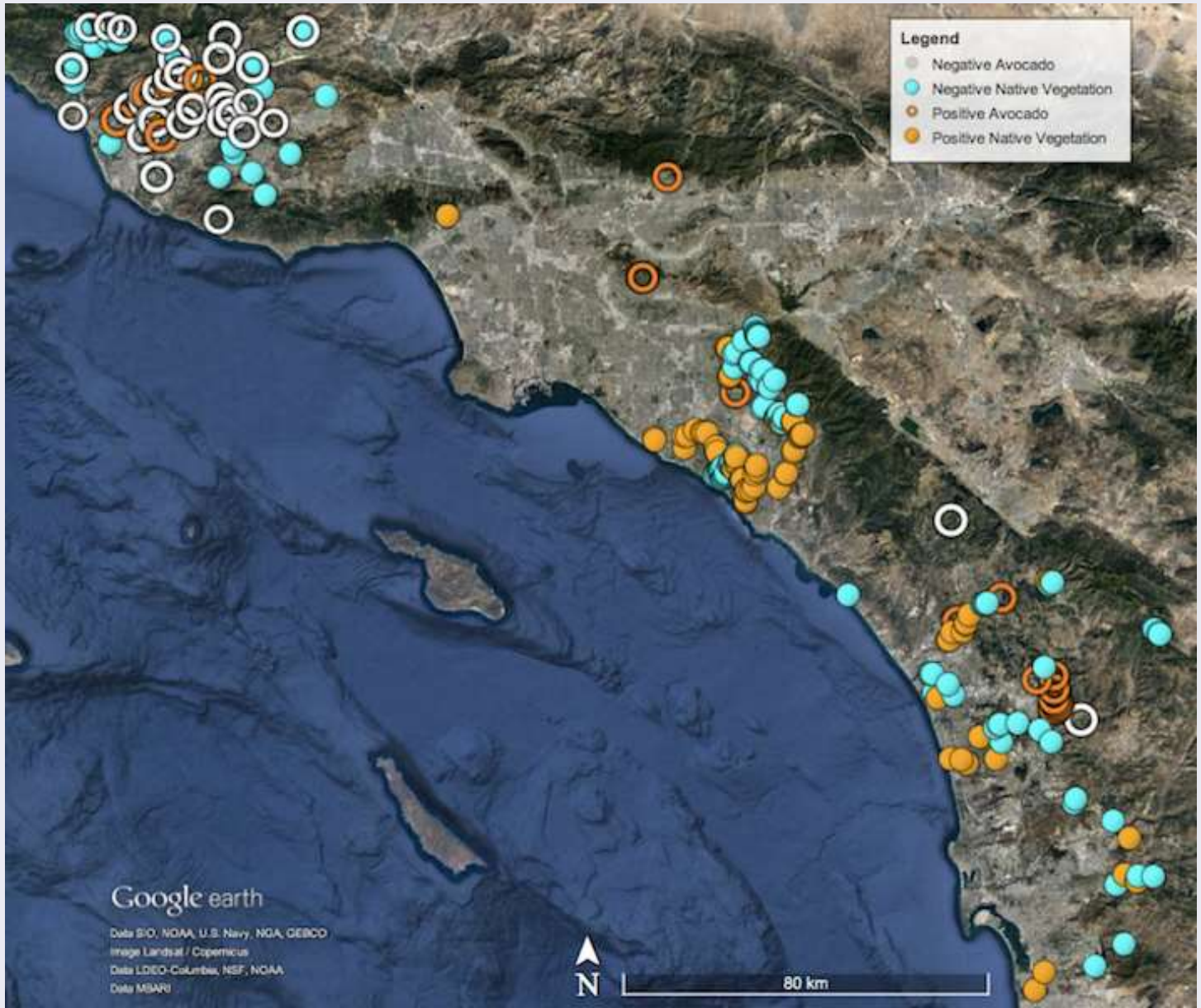


Parker et al. 2015. *Nature*

Landscape Structure

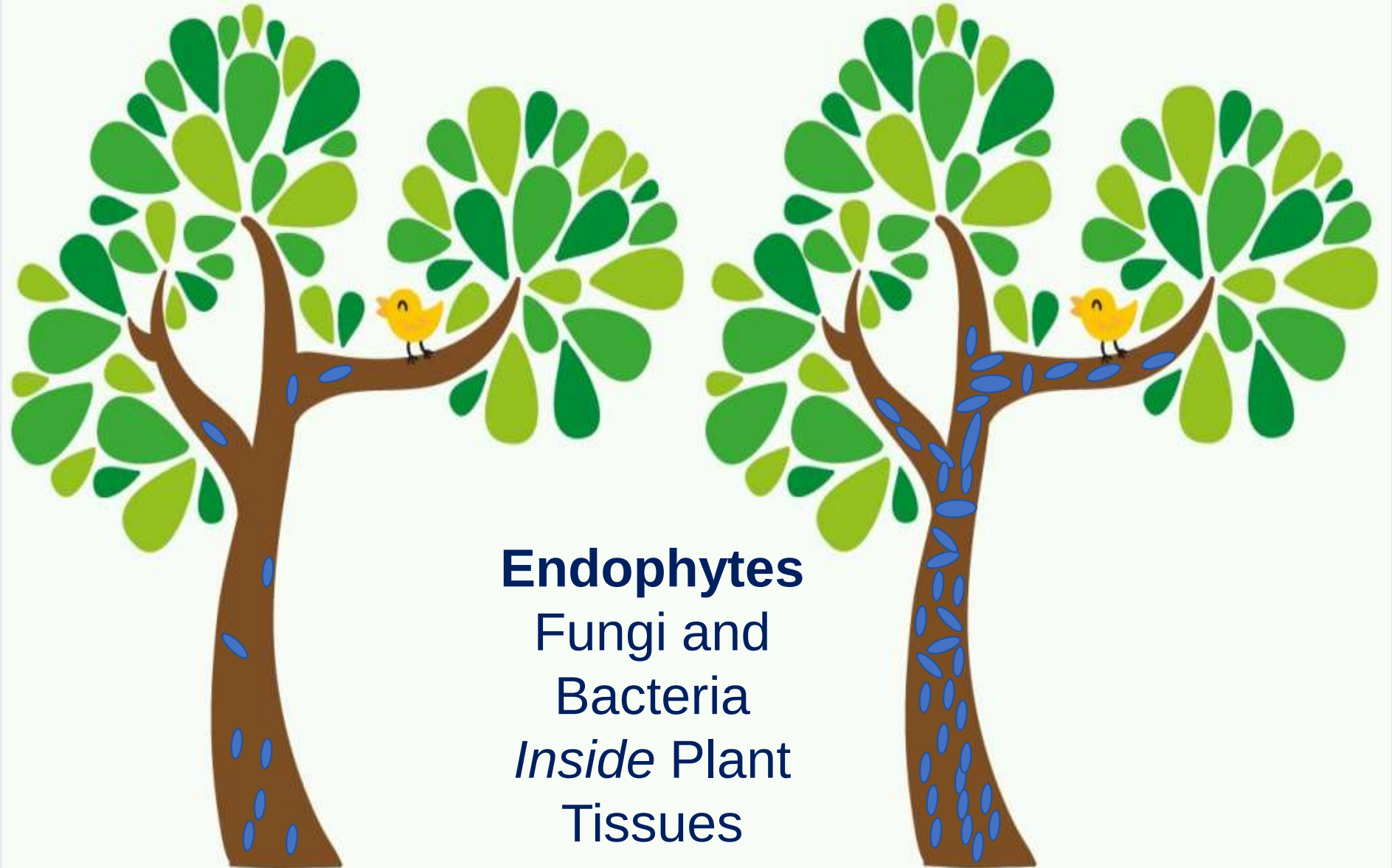
Fusarium-dieback Shot Hole Borers

Predicting risk in heterogeneous landscapes



Host Composition
Host Abundance
Microclimate

Host Microbiome and Disease Dynamics

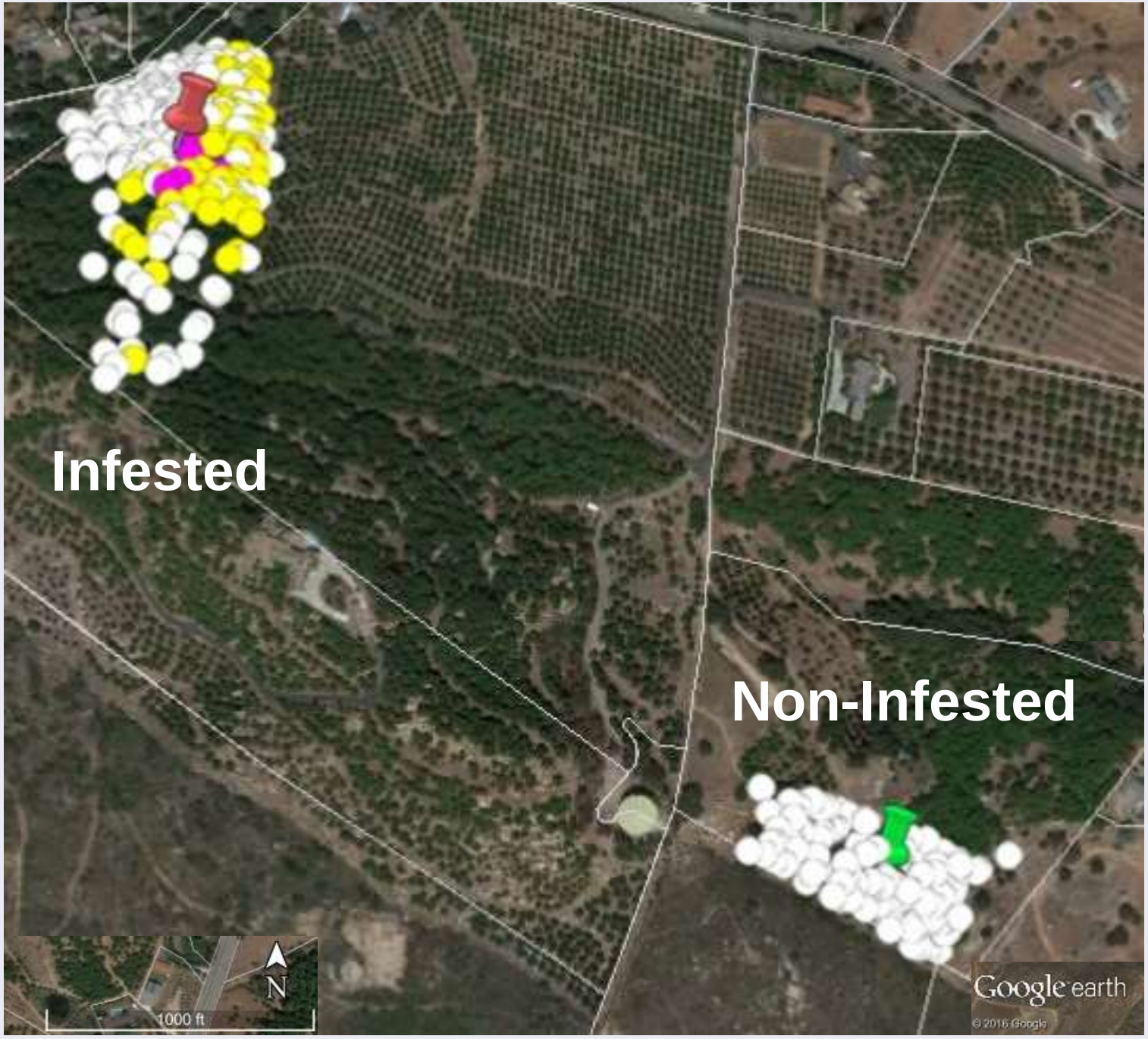


Endophytes
Fungi and
Bacteria
Inside Plant
Tissues

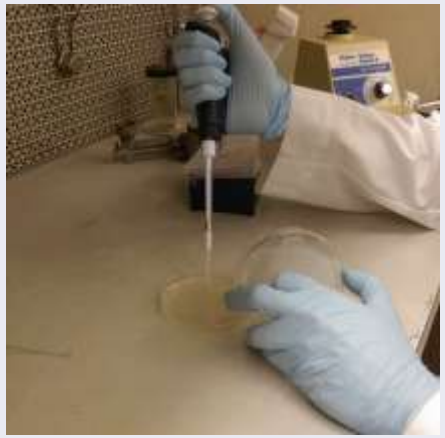
Non-Infested Sycamore in a Disease Hot-Spot

March 2016

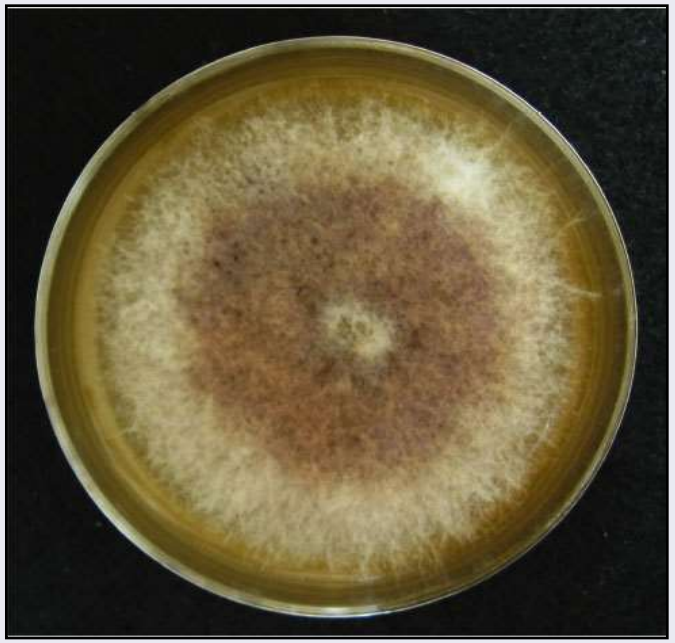
November 2016

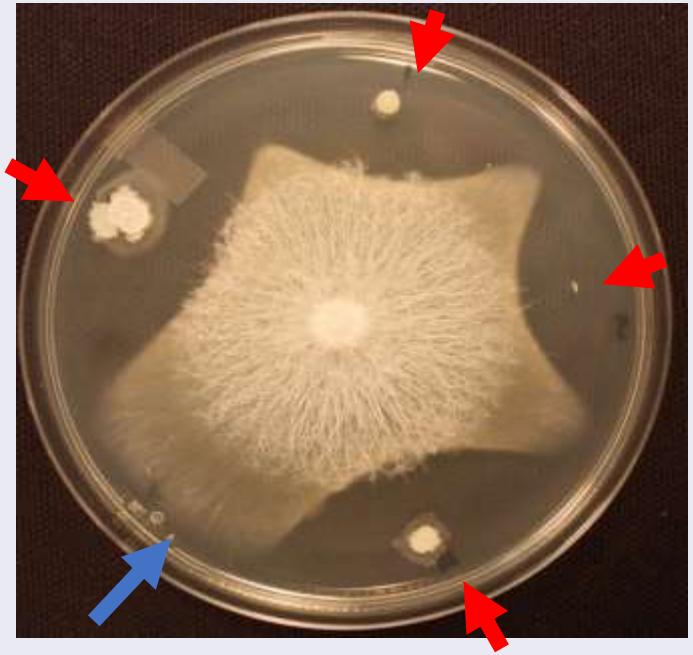

Infested
Non-Infested
N
1000 ft
Google earth
© 2016 Google

Preliminary Endophyte Screening



In vitro Inhibition Bioassays



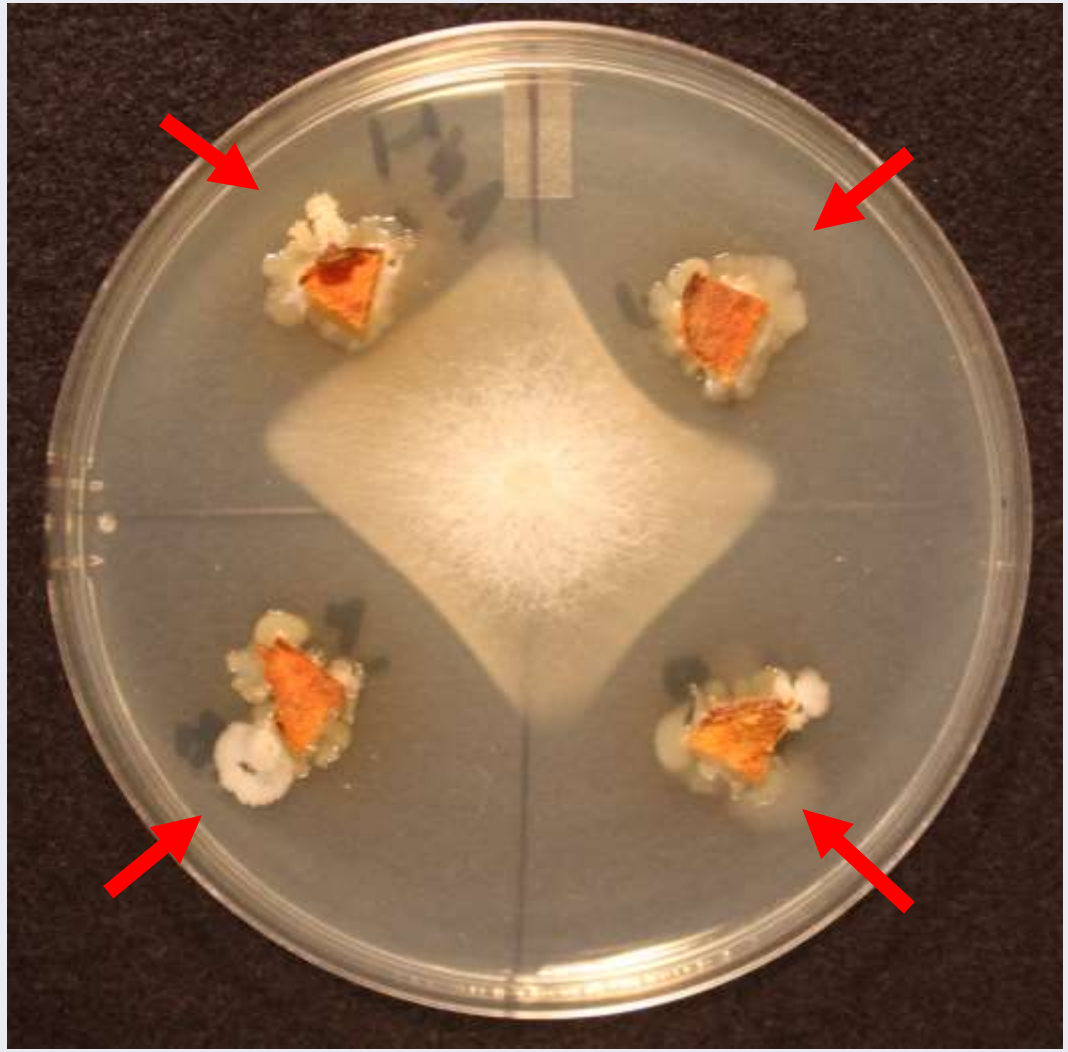


Control

Treatment

No Inhibition **Inhibition**

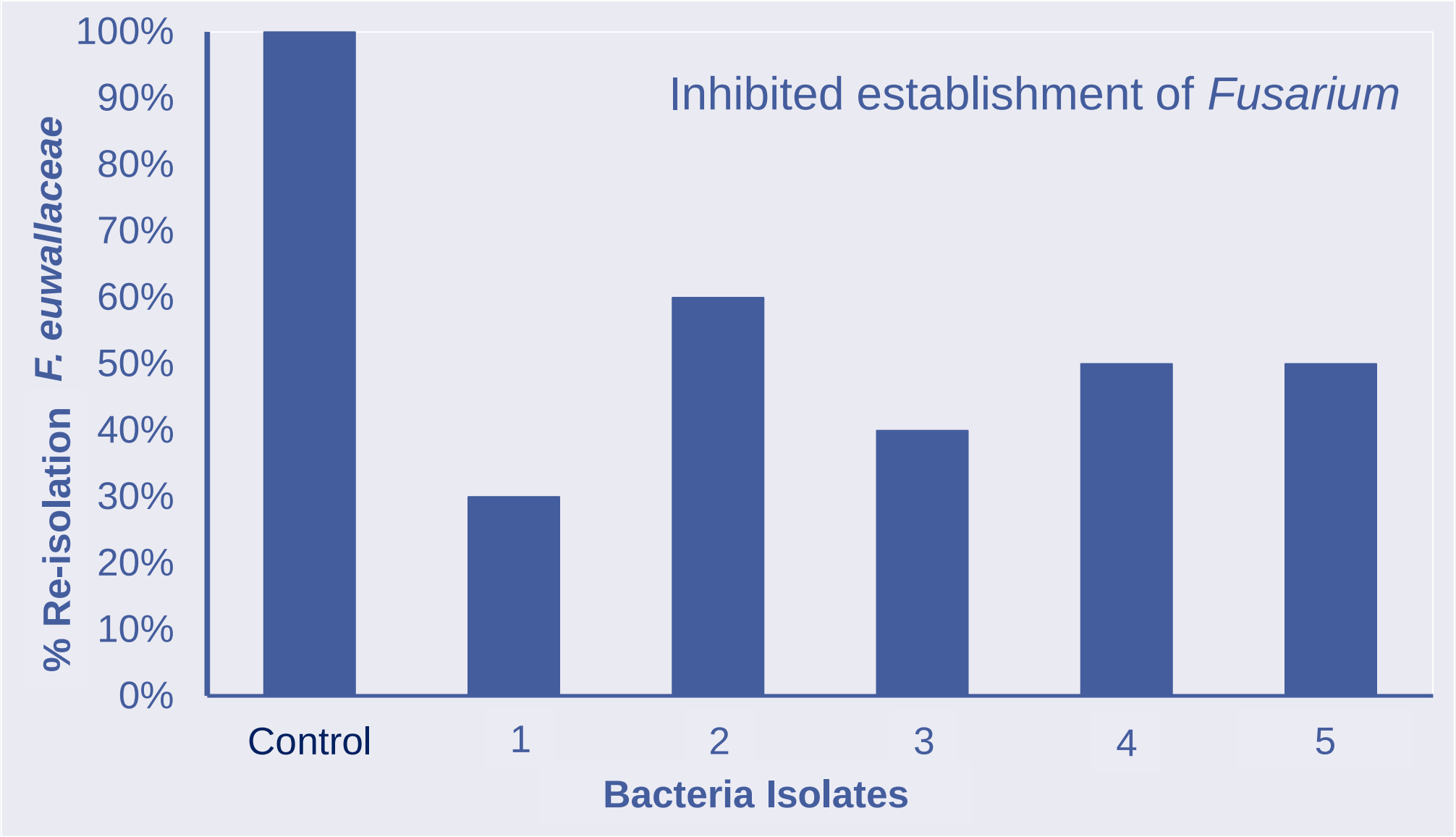
Inhibition Bioassays



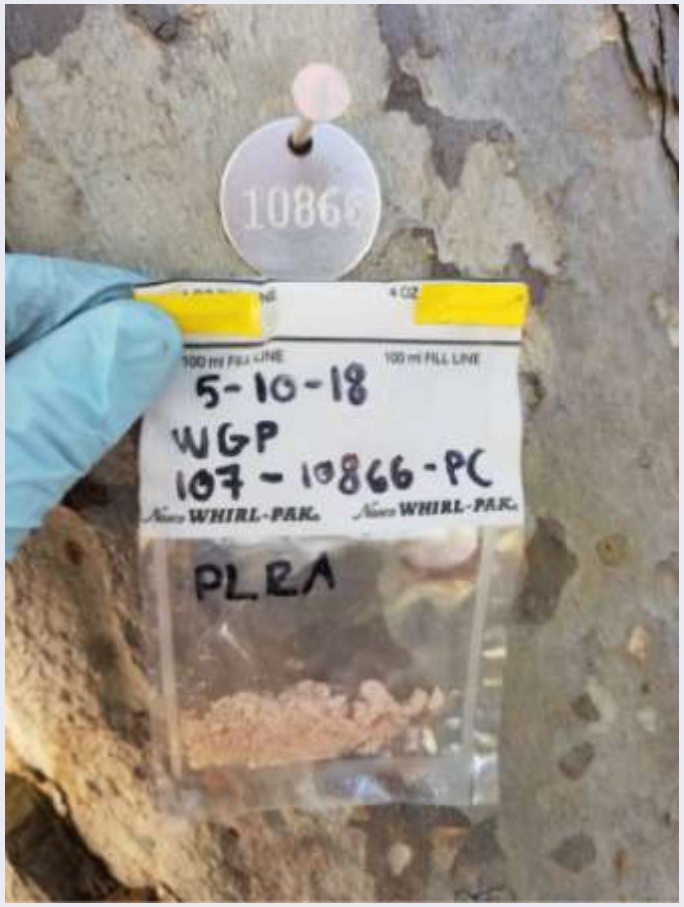
In planta

No Inhibition **Inhibition**

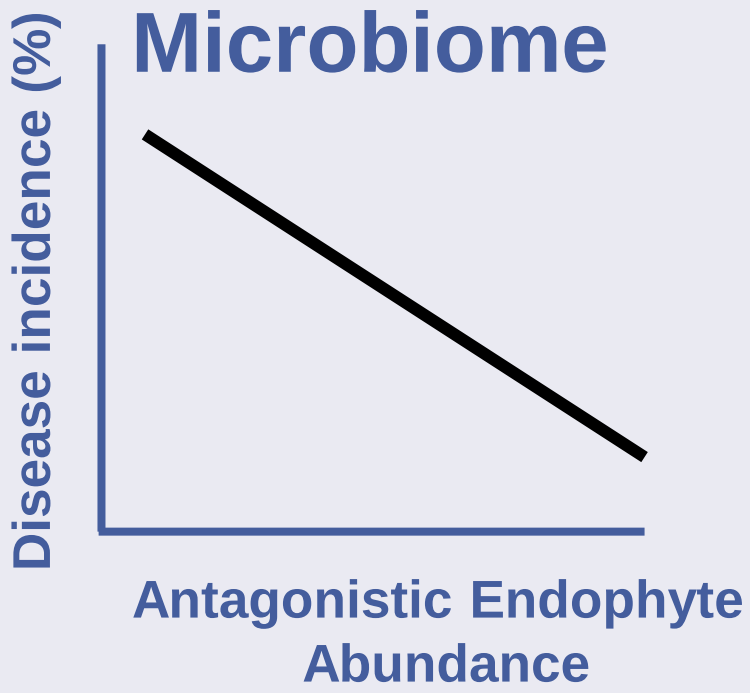
Preliminary Bioassay Results

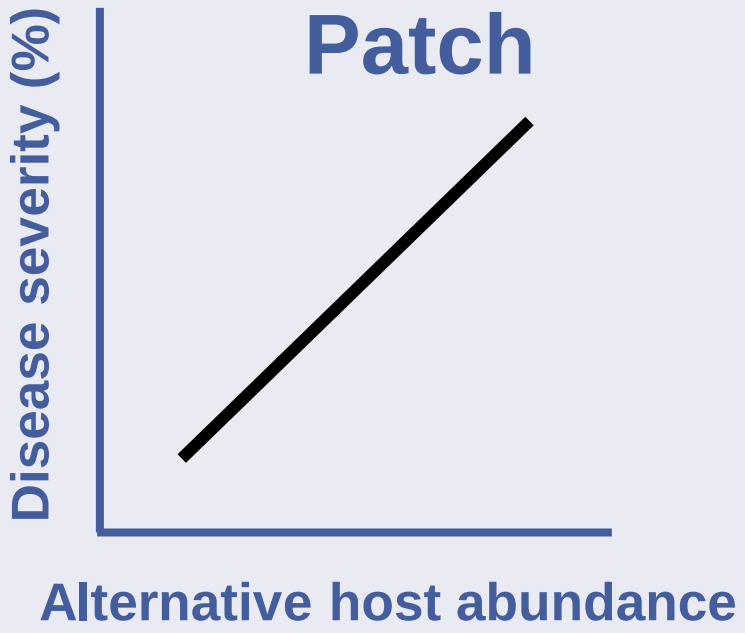


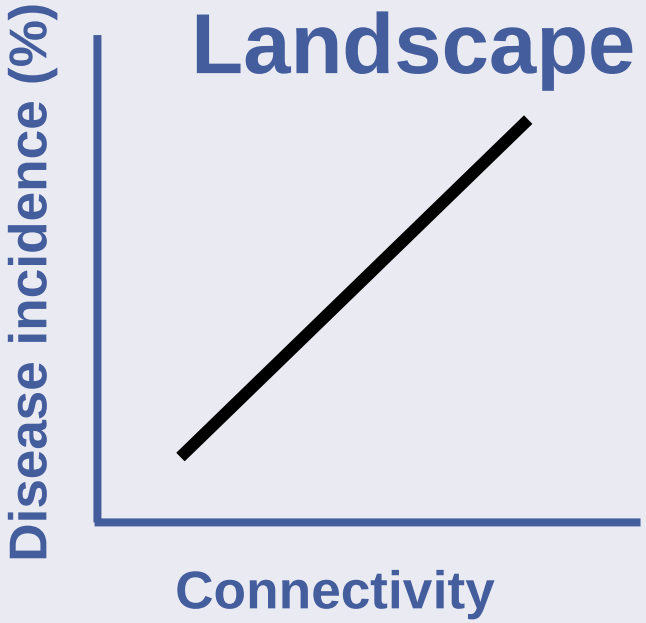
Endophyte Screening in Native Vegetation



Predicting Disease Establishment and Spread







Predictive Model

p(pS) ~ microbiome + phylogenetic + microclimate + landscape

Predictive Model Use

Control Options

Cultural, physical/mechanical

Chemical

Biological

Long Term Strategy

Conclusions

- Early detection tools have been developed

- We are assessing the scope of the problem based on:

  1) Evolutionary ecology of the fungi and beetles;
  2) Microbial communities inside hosts;
  3) Environmental conditions;
  4) Landscape features.

- Goal: facilitate strategic management decisions

Thank You

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OC parks
The Nature Conservancy
SANDAG
Los Angeles Center for Urban Natural Resources Sustainability
Natural Communities Coalition
restoration | management | partnership
California Department of Fish & Wildlife
Irvine Ranch Conservancy
California Avocado Commission
cdfa
California Department of Food & Agriculture
Southern California Botanists Founded 1927
CNPS California Native Plant Society
Sea & Sage Audubon Society
An Orange County Chapter of the National Audubon Society
Sigma Xi
The Scientific Research Society

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