

# SOD BLITZes 2018: Results & New SOD Management Recommendations

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**Natural Resources**  
UNIVERSITY OF CALIFORNIA, BERKELEY

# **SOD Blitzes: a unique citizen science program**

- Yearly volunteer-based survey to track expansion and contraction of the pathogen's range
- Volunteers collect over a weekend
- **UC Berkeley tests all samples**
- **Early Fall, results of yearly blitz are available and made public**
- Mid Fall, Blitz results added to SODmap
- SODmap mobile accesses data from SODmap :
  - App allows to identify sampled trees in the field
  - App calculates risk for oak infection at any location

# Funding and acknowledgements

- United States Forest Service
  - **Region 5: Susan Frankel**
  - **State and Private Forestry: Phil Cannon**
- PG & E Foundation, San Francisco
- Mid Pen Open Space
- Local Organizers and CNPS who make the Blitzes possible
- Local and State organizations: Save Mount Diablo, National Parks, SFPUC, Mid Pen Open Space, Santa Lucia Preserve, State Parks, the UCSC Bot Garden, East Bay Regional Parks, Calfire, Sonoma State University
- Doug Schmidt, U.C. Berkeley

- [www.TreeFAQs.org](http://www.TreeFAQs.org)
- Tree Health  
Answers & Questions
- Good or new  
questions are  
published

**UC BERKELEY FOREST PATHOLOGY AND MYCOLOGY LAB**

Home New Treatment & Diagnosis Contact Publications **FAQ** Blog English 09/30/2014

You are here: Home / THANQs - FAQ

## THANQs – FAQ

### Tree Health Answers & Questions

Ask the experts any questions about tree health, diseases, or management...

#### General Tree Care

[When should I remove a tree?](#)  
[What is the Critical Root Zone around a tree?](#)

#### Oak Tree Care

[How many kinds of oaks are there in California?](#)  
[What's the Gold Spotted Oak Borer?](#)  
[What can I plant under my oaks?](#)  
[I have insect larvae in my oak acorns, what do I do?](#)  
[Should I water my oak trees during the drought?](#)


#### Sudden Oak Death


[How can I tell if my trees have SOD?](#)  
[Are there any treatments for SOD?](#)  
[Are there any SOD meetings or workshops?](#)  
[How can I get my trees tested for SOD?](#)


#### Ask a Question or Leave a Comment


Name \*  
 Email \*  
 Website


#### Featured

  
 SOD: Cleaning Tools & Equipment

  
 What is Sudden Oak Death?

  
 Wood Decay Diagnostic

  
 SOD Treatments

  
 Fun with Fungi: Mycology Careers

# By submitting a question to **TreeFAQs.org**

- You will get an answer within approximately a week by the best experts in the field
- Your question will be published on the website by the same name and thus you will help to build a database of FAQs for California

# You can also use [TreeFAQs.org](https://treefaqs.org)

- To let us know of wrong location of your samples on the SOD blitz map
- Please double check accuracy of sampled trees and provide us with feedback to improve quality

# Sodblitz.org

- Summary table of 2018 SOD Blitzes
- Google Earth map of 2018 SOD Blitzes
- Conversion excel file that allows *blitzers* to identify trees they sampled

# Sodmap.org

- Google earth map of all SOD distribution data (updated when new blitz results come in)
- SOD heat maps

# **Sodmapmobile.org**

- Companion file that explains in depth how to best use the free APP (Apple and Google Play)

*We are renewing permission to upload APP*

## **SODmap mobile**

- Video that shows how to use the APP

## **SODmap mobile**


# **Matteolab.org**

- All other websites contained in it
- New recommendations to manage SOD



[www.sodblitz.org](http://www.sodblitz.org)  
(TOP)

SOD Blitz 2018/2008 Google Earth Map Overlay



Click for Map

Get Google Earth? Download and install Google Earth here

### SOD Blitz 2018 Results

Showing 1 to 30 of 30 entries

Location	Surveyed Trees	Symptomatic Oak Mortality %	Sampled Trees	SOD Positive Sampled Trees %	Estimated True Infection Rate %	Symptomatic Surveyed Trees %
Agua	87	18.1	21	4.8	3.8	40.9
Carre	400	2.0	218	2.3	1.1	16.2
East Bay East	86	10.5	48	22.9	12.1	30.4
East Bay South	34	0.0	6	0.0	0.0	1.4
East Bay West	884	0.0	87	0.0	1.1	18.0
Marin	9005	22.0	116	8.6	2.0	28.0
Marin North	800	16.3	31	6.5	1.4	20.0
Napa	80	0.0	40	2.5	1.0	40.0
Napa East	815	17.9	182	50.0	9.0	57.0
Napa North	127	0.0	23	2.2	0.0	28.0
Napa South	800	10.0	94	42.0	19.1	40.0
Napa West	2228	22.2	409	31.4	6.1	34.0
San Francisco	2462	0.0	198	0.0	0.0	9.0
San Luis Obispo	644	0.0	138	0.0	0.0	16.7
San Mateo	224	0.0	90	0.0	0.0	40.0
Shasta East	246	17.9	78	21.3	6.0	44.0
Shasta North	124	18.0	37	0.0	1.0	20.0
Shasta West	800	10.0	160	50.0	0.0	28.0
Trinity Humboldt Butteville	118	0.0	24	0.0	0.0	19.0
<b>Total</b>	<b>12041</b>	<b>10.0</b>	<b>2242</b>	<b>9.9</b>	<b>3.5</b>	<b>38.0</b>

Showing 1 to 30 of 30 entries

Page 1 of 1

Map Number of 2018 SOD Blitz Collection: 1.004

Google Map of Results

Results in Table format

Total Number of 2008-2016 Blitz collections = 304

### SOD Blitz Community Meetings and Workshops Schedule

**SOD Blitz Results Fall 2016**

SOD Blitz (SOD Blitz) is a citizen science program through which participants are trained to identify insect eggs and larvae in their backyards and to properly collect samples, allowing for a community-based survey of invasive species in California. Samples are collected on SOD Blitz, and results are visible on a map of California. SOD Blitz is a community-based program. SOD Blitz can be accessed online (online) or through the App SODmap mobile. The App also includes information on how to collect samples by SOD Blitz at the physical location of the site.

- 21 Sites, covering several California counties from the Oregon border to San Luis Obispo County, including three in central Italy.
- 30% more of the total SOD Blitz sites and began online collection programs in the west (starting in California, Oregon, and Idaho).
- 3,584 eggs were collected and 2,012 eggs were collected by 307 volunteers. The California Statewide Internet rate in 2016 was estimated to be 3.7%, a significant drop from the 12.8% recorded in 2015.
- San Luis Obispo and Redwood Counties were all included in SOD Blitz 2016. The sites were for a 10-year period of a 10-year period.
- The South Coast Community project, including projects in Santa Barbara, Santa Monica and Santa Monica, were all included in SOD Blitz 2016.
- The SOD Blitz

Download PDF (207 KB)

Commentary on Results

Videos on what to do

3 Steps to manage sudden oak death



SODmap Mobile App

**SOD Risk Assessment**



[Link to 2017 SOD Blitz Results](#)

[Link to 2016 SOD Blitz Results](#)

[Link to 2015 SOD Blitz Results](#)

[Link to 2014 SOD Blitz Results](#)

[Link to 2013 SOD Blitz Results](#)

[Link to 2012-2008 SOD Blitz Results](#)

Previous years results

[www.sodblitz.org](http://www.sodblitz.org)  
(BOTTOM)

[illegible]

Conversion file  
To identify numerical code  
For each tree

# SOD Blitzes 2018:

## some statistics

- A total of 23 Blitzes, including three on tribal lands, Kurok , Pomo, Kashia. Largest area ever surveyed
- Siskiyou (Oregon border) the Northernmost
- San Luis Obispo (Santa Barbara border), Southernmost
- 304 collectors, 500 participants
- Trees surveyed: 13504 !
- Trees sampled: 2012
- Statewide Rate of Positive trees 9.8%
- Statewide True Infection rate: 3.5%: **a third respect to last year's True Infection rate**

## Citizen science helps predict spread of sudden oak death

By [Sarah Yang](#), Media Relations | May 1, 2015

**BERKELEY** — Efforts to predict the emergence and spread of sudden oak death, an infectious tree-killing disease, have gotten a big boost from the work of grassroots volunteers.

A joint study reveals the power of citizen science in SOD Blitz, a survey project in which volunteers are trained to identify symptoms of sudden oak death. Led by Matteo Garbelotto at UC Berkeley and Ross Meentemeyer at North Carolina State University, the study was published today (Friday, May 1) in the journal *Frontiers in Ecology and the Environment*.

Sudden oak death is a fungus-like disease that has felled hundreds of thousands of trees in California. Crowdsourcing the survey and sampling work allowed researchers to gather information that would otherwise be too impractical and cost-prohibitive to obtain. Researchers then used the data to create a model that predicts the presence of the sudden oak death pathogen, *Phytophthora ramorum*, based upon such variables as rainfall and density of host trees.

Study authors compared the model based upon crowdsourced data gathered from the 2008-2013 blitzes with models using "pre-Blitz" research observations collected from 2000 to 2007. They found the SOD Blitz model to be more powerful, correctly predicting the presence of the pathogen 74 percent of the time, compared with models based on other sources of data.



Two volunteers collect samples in the East Bay during the 2014 SOD Blitz. (Photo by Douglas Schmidt, UC Berkeley)

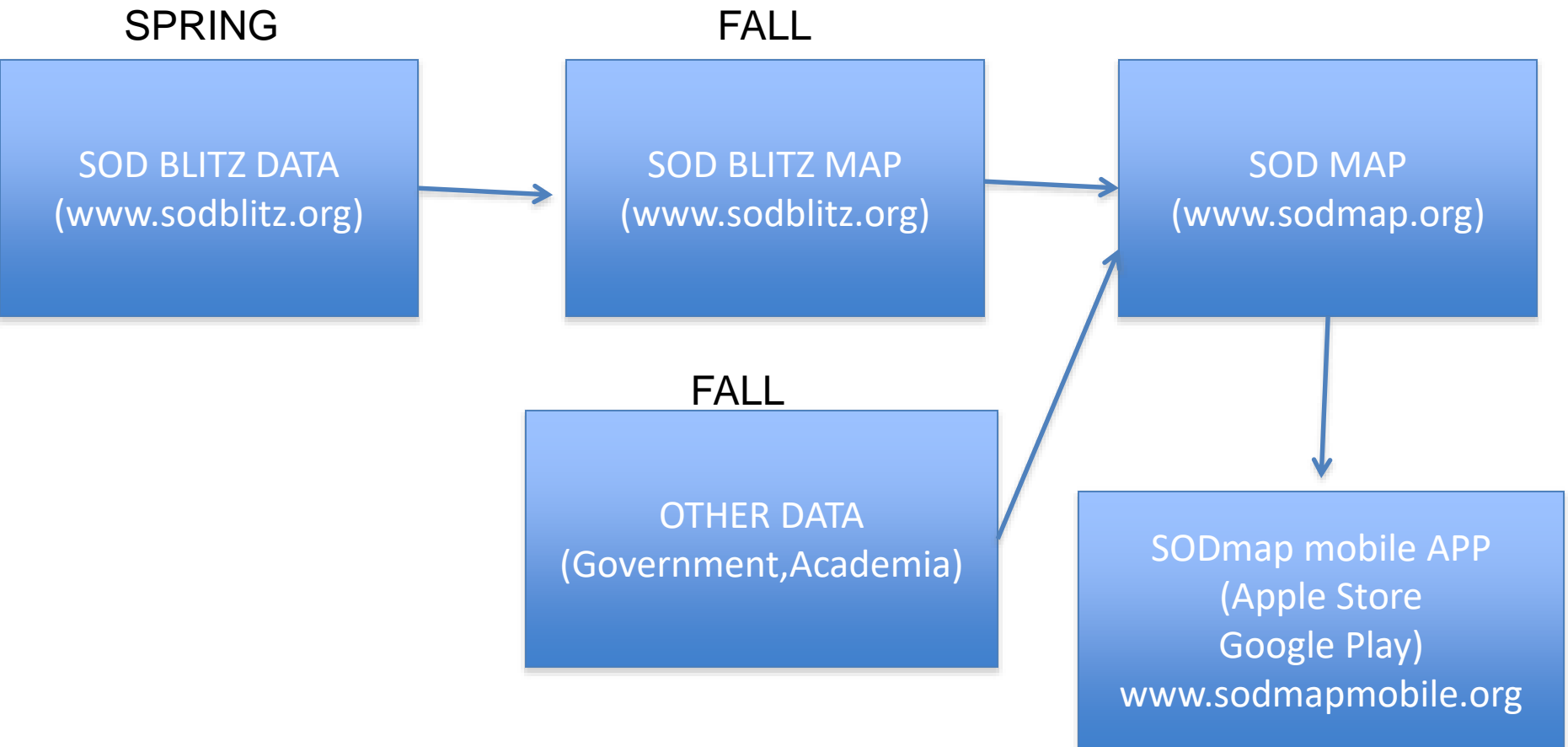
**NEW COMPONENT OF SOD BLITZ PROGRAM IN 2019!!**

Treatment Name	Cost	Area treated (acres)	# of infected trees removed	# of total trees removed	# of oaks saved	Percent reduction in Spread
multi-landowner	\$1,000	2.25	5	7	3	2.50%
Neighborhood	\$2,500	25	20	30	8	7.00%
single landowner	\$500	1.25	2	5	2	2.00%

## Crowdfunded Management

- Use current SOD blitz data to inform dynamic spatial model
  - Connect a crowdfunded management solution similar to Kickstarter (but for management)
- Run the model with and without management solutions to get metrics for effectiveness of the management
- Users then select and fund management they want to see, once a treatment is 50% funded by users, grant funds match the funding and the management is completed.

# Data flow chart



2018 2017

Location	Estimated True Infection Rate %	Estimated True Infection Rate %
Big Sur	3.8	55.3
Carmel	1.1	18.9
East Bay-East	12.7	15.7
East Bay-South	0.0	0.0
East Bay-West	1.1	7.5
Marin	2.5	21.3
Mendocino	1.4	1.2
Napa	1.5	0.5
Peninsula-East	6.0	35.9
Peninsula-North	1.0	6.5
Peninsula-South	19.1	38.1
Peninsula-West	6.1	14.3
San Francisco	0.0	1.3
San Luis Obispo	0.0	0.0
Santa Cruz	3.6	19.4
Sonoma-East	9.7	32.9
Sonoma-North	1.8	3.9
Sonoma-West	2.9	21.1
Trinity-Humboldt-Siskiyou	0.0	0.0
Total	3.5	12.8

-Significant generalized reduction in estimated infection rates

-Some of the reduction due to drier weather in 2018, some due to different sampling intensity

-Areas that were SOD free in South and North remain SOD free

-Urban outbreaks less prevalent, but still present

-Closer look at map reveals new outbreaks in Sonoma, San Mateo, Santa Clara, Santa Cruz Counties

-SOD Blitz identifies southernmost Infected tree!!!

-Easternmost outbreaks not detectable In dry weather



# Note that:

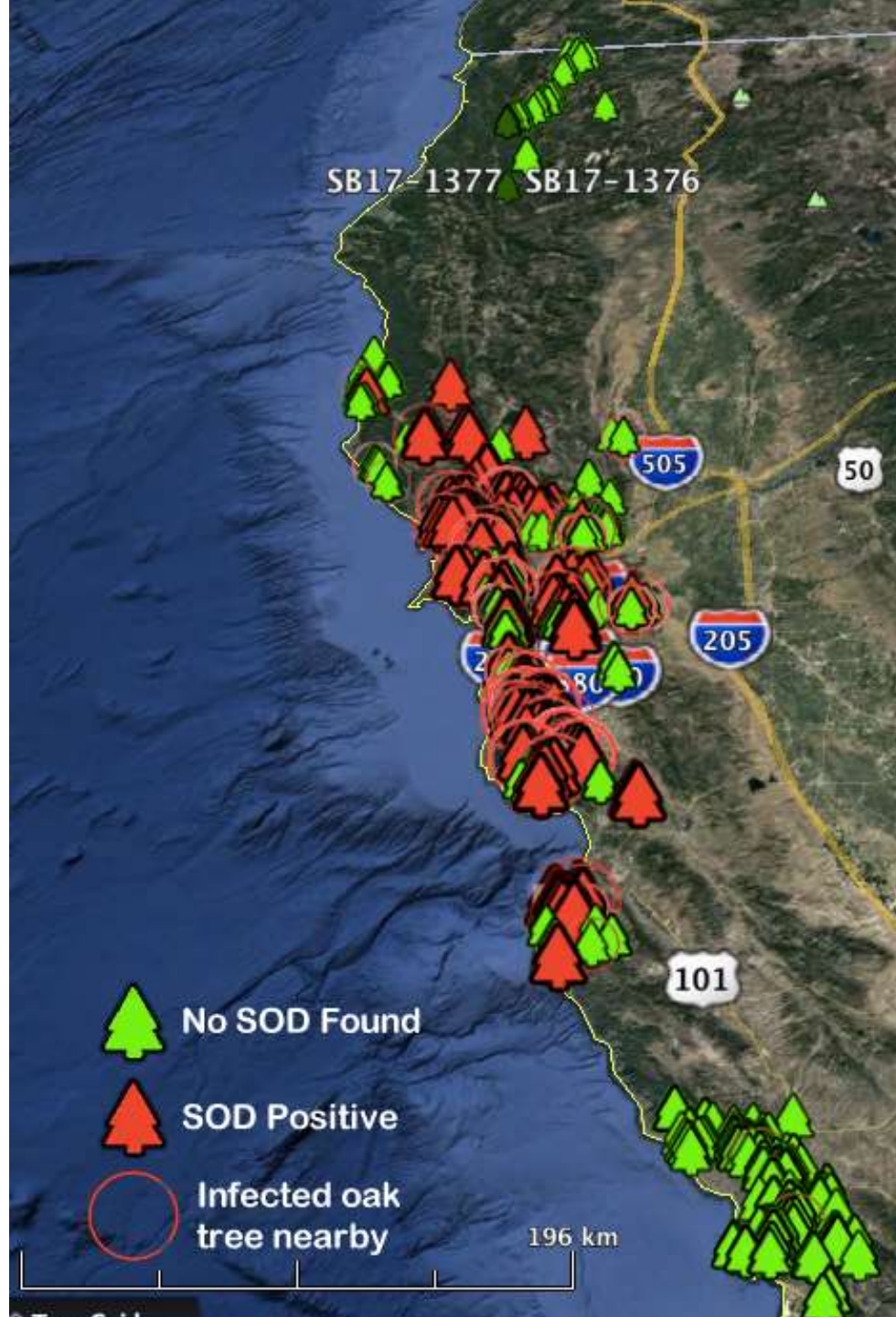
- Probably only statewide % infection is easily comparable between years, due to “haphazard” sampling approach of SOD Blitzes
- There are two main sampling/survey approaches:
  - Focusing on symptomatic trees whether extensively (one sample every 100 yards) or intensively (one sample every 10 yards)
  - Set up of sentinel trees to catch infection when it first arrives: Trinity, Mount Diablo, San Luis Obispo

# Know that:

- Infection on bay laurel indicates arrival of the pathogen but oak infection may require several more years and one or two years with higher than average rainfall, however if bays have tested positive for SOD, that is the indication it may be necessary to preventatively protect your trees from the pathogen

# Know that (important):

- SOD Blitzes 2018 reported an increase in symptomatic (dead or dying) oaks from **9% to 12%**. Increase in symptoms may be due to both SOD and drought related issues. At the same time drier weather resulted in a decrease of symptoms on bay laurels from **40 to 35%**
- SOD Blitz results anticipate oak infection: in fact last year's unprecedented high infection of bays resulted in high levels of oak and tanoak infections, and that will continue into the next two/three years. Symptomatic oaks this year, the next year, and the year after next are all oaks infected last year



- Google Earth Platform
- All colored icons were tested
- Red= has SOD
- Green= had symptoms but not SOD
- Circle means oaks dying but for any reason (e.g drought)



Use these commands to:

move around map

enlarge it

Even when magnified, icons will stack. Click on one to see all icons in a so called spiderfy



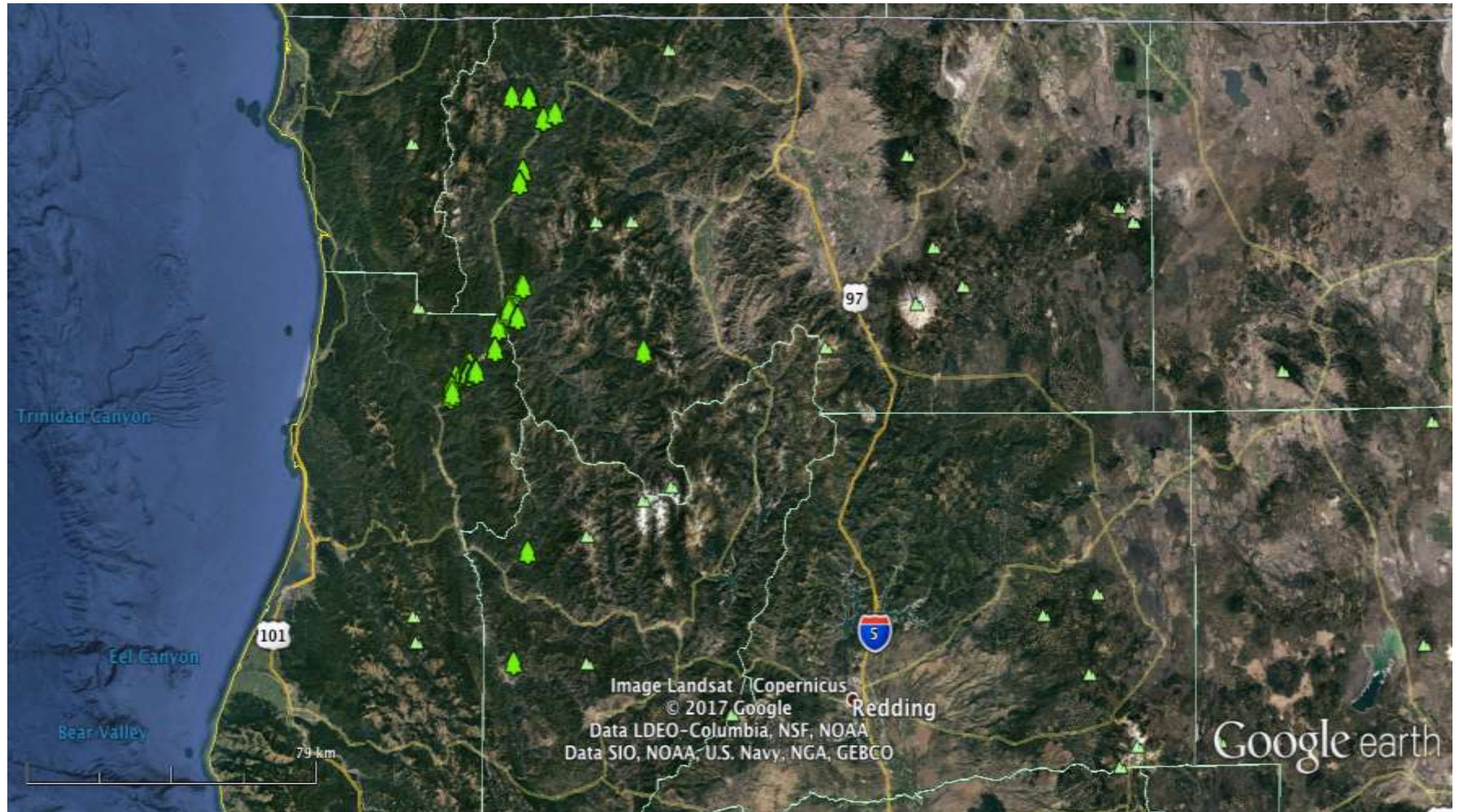
# Most Interesting Findings of 2018

## Blitzes- I

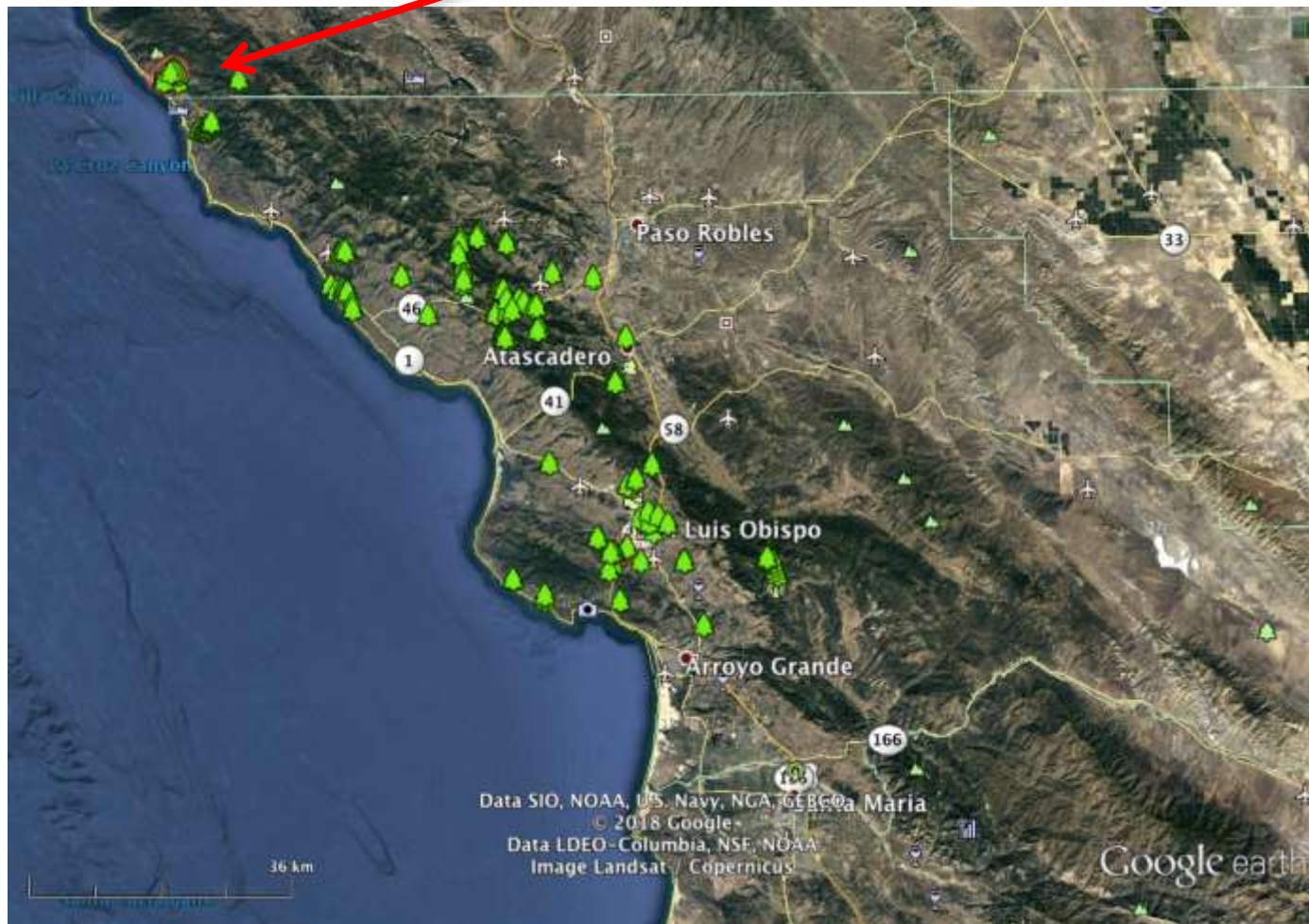
- San Luis Obispo County has been intensively resurveyed and all results indicate it is negative for SOD
- Note that 2018 Blitz finally identifies positive tree in Salmon Creek, South Monterey. SOD pathogen was only detected in water prior to Blitz
- Siskiyou county samples were all negative, same for North Eastern Humboldt and Trinity (note that Humboldt and Trinity have confirmed SOD in other locations)



# Sentinel networks: Siskiyou negative in 2018

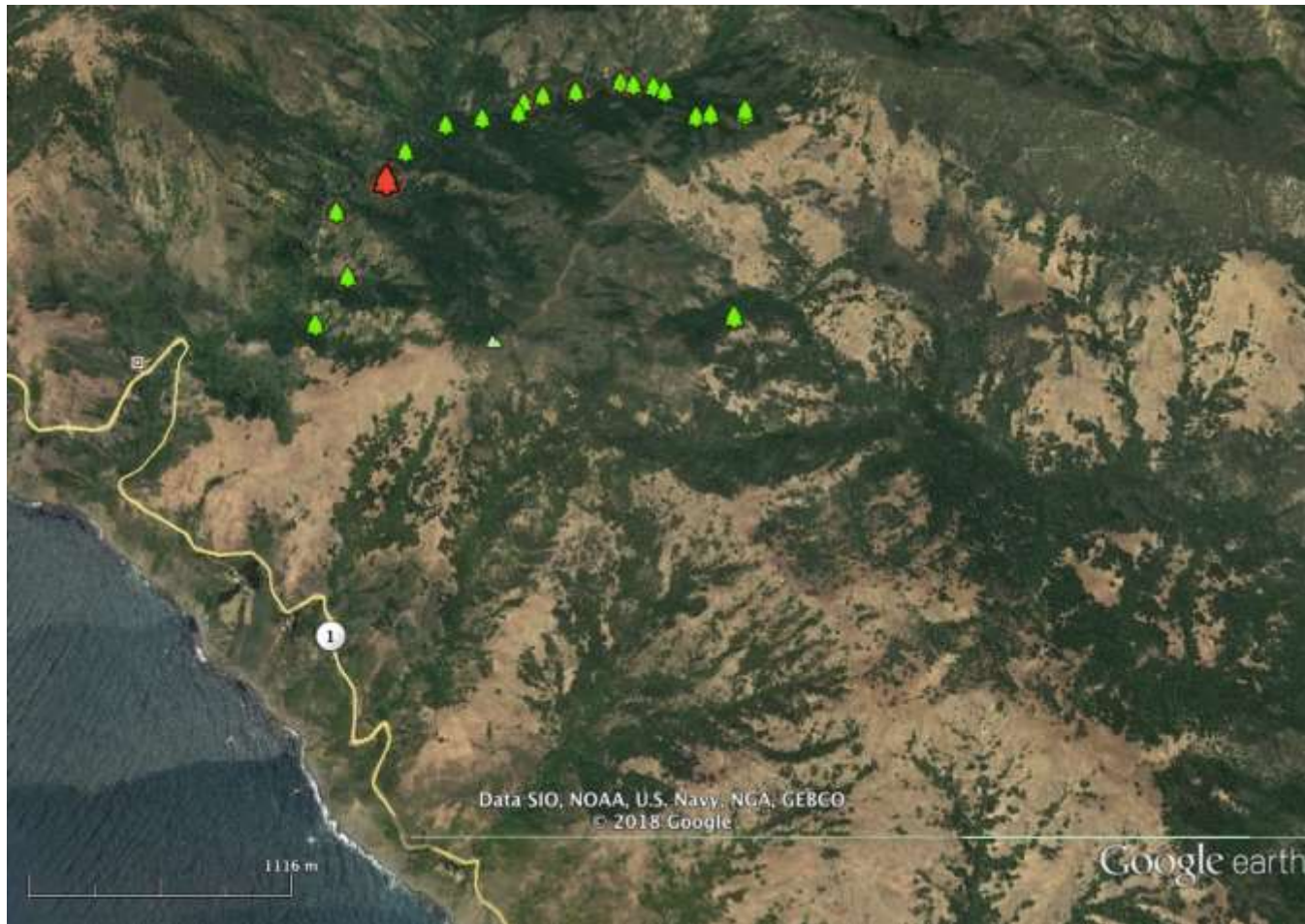


# Sentinel networks: San Luis Obispo negative in 2018, but positive in Salmon Creek Canyon





# Salmon Creek Canyon

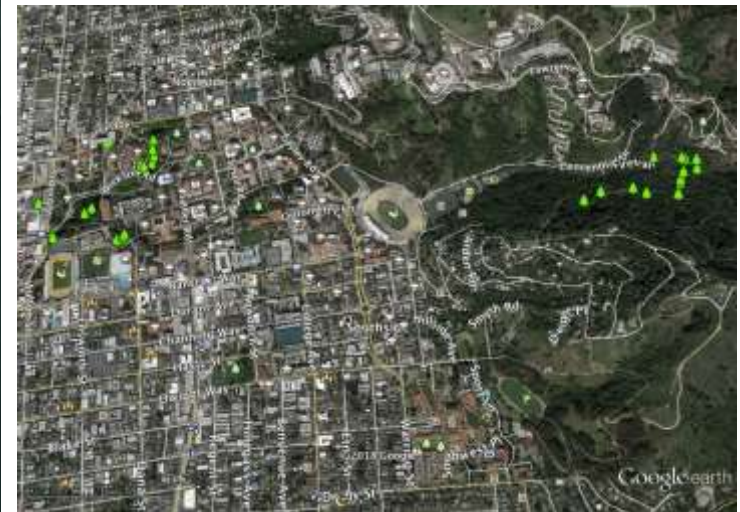


Monterey  
San Luis O

# Most Interesting Findings of 2018

## Blitzes-II

- San Francisco and U.C. Berkeley campus were well sampled and both were negative!!!

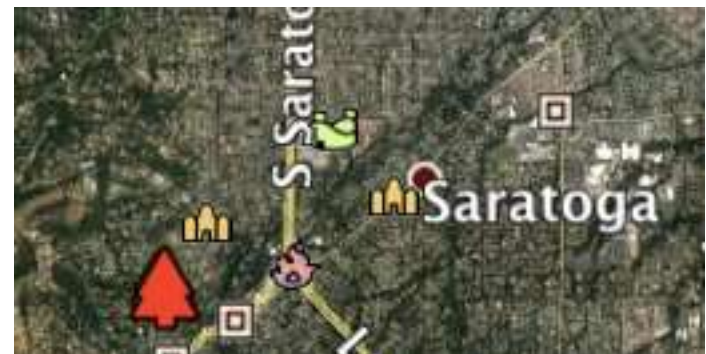




# Most Interesting Findings of 2018

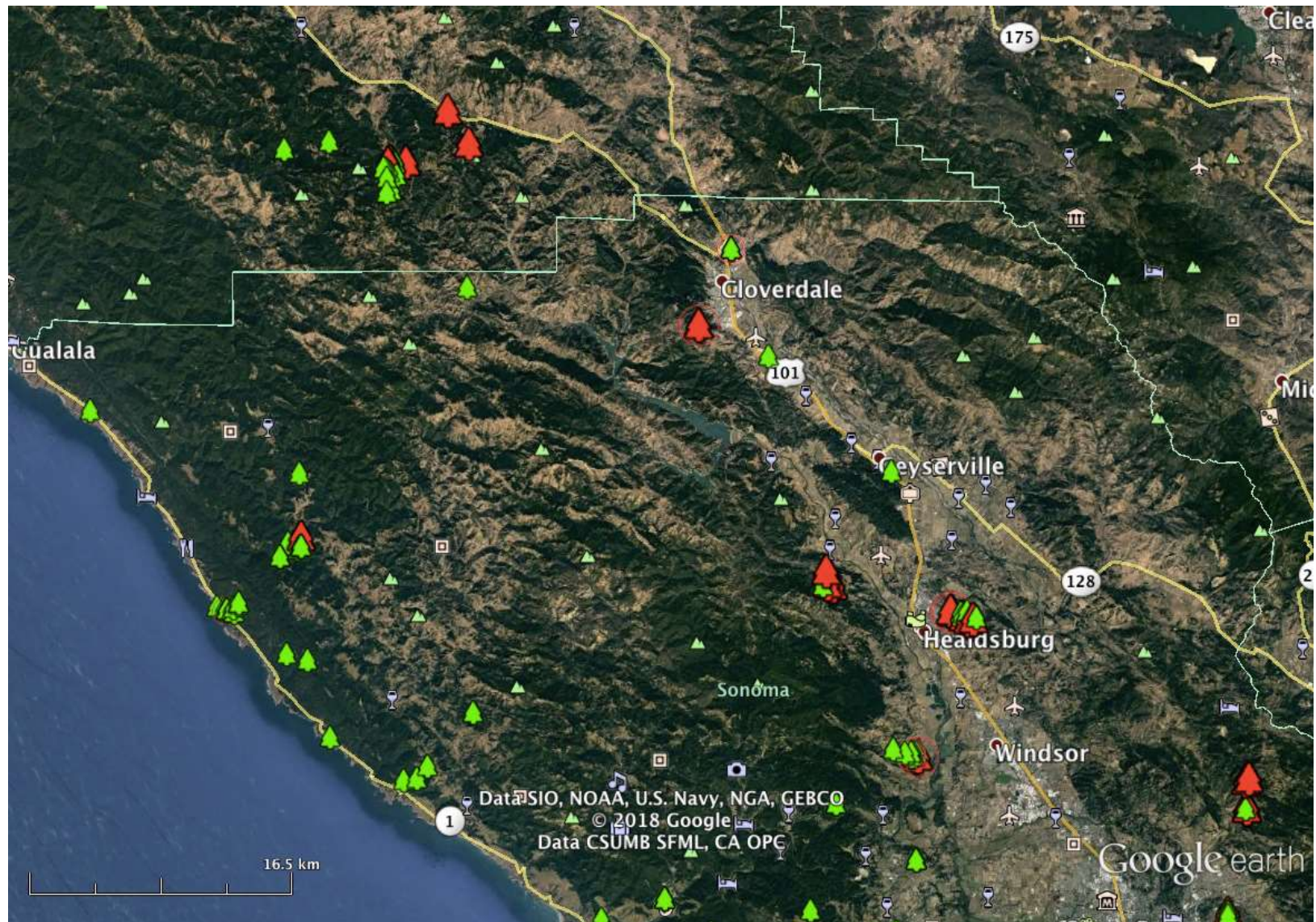
## Blitzes-III

- Outbreaks in urban areas still present but decreasing



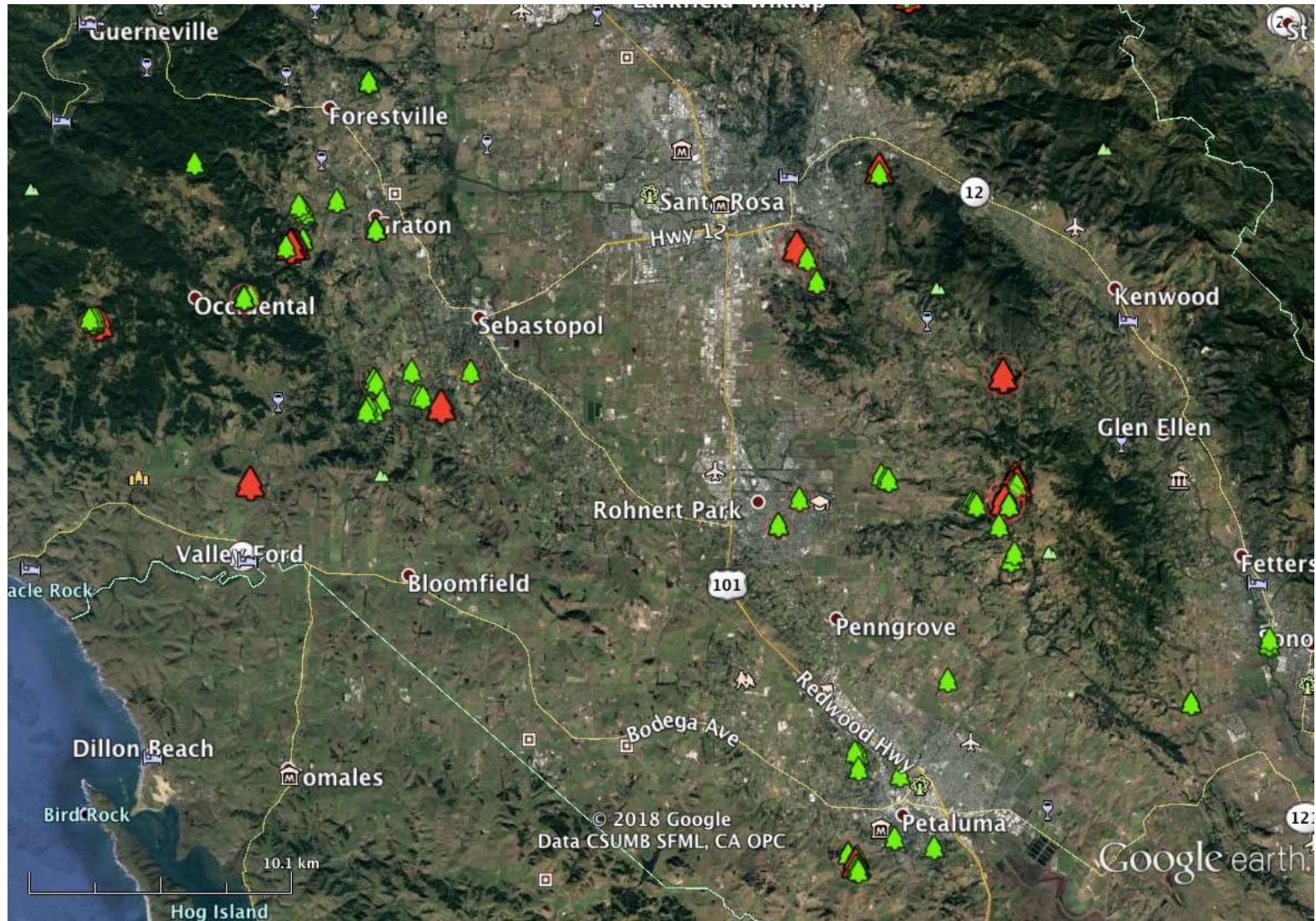


# Northern Sonoma and Southern Mendocino Counties



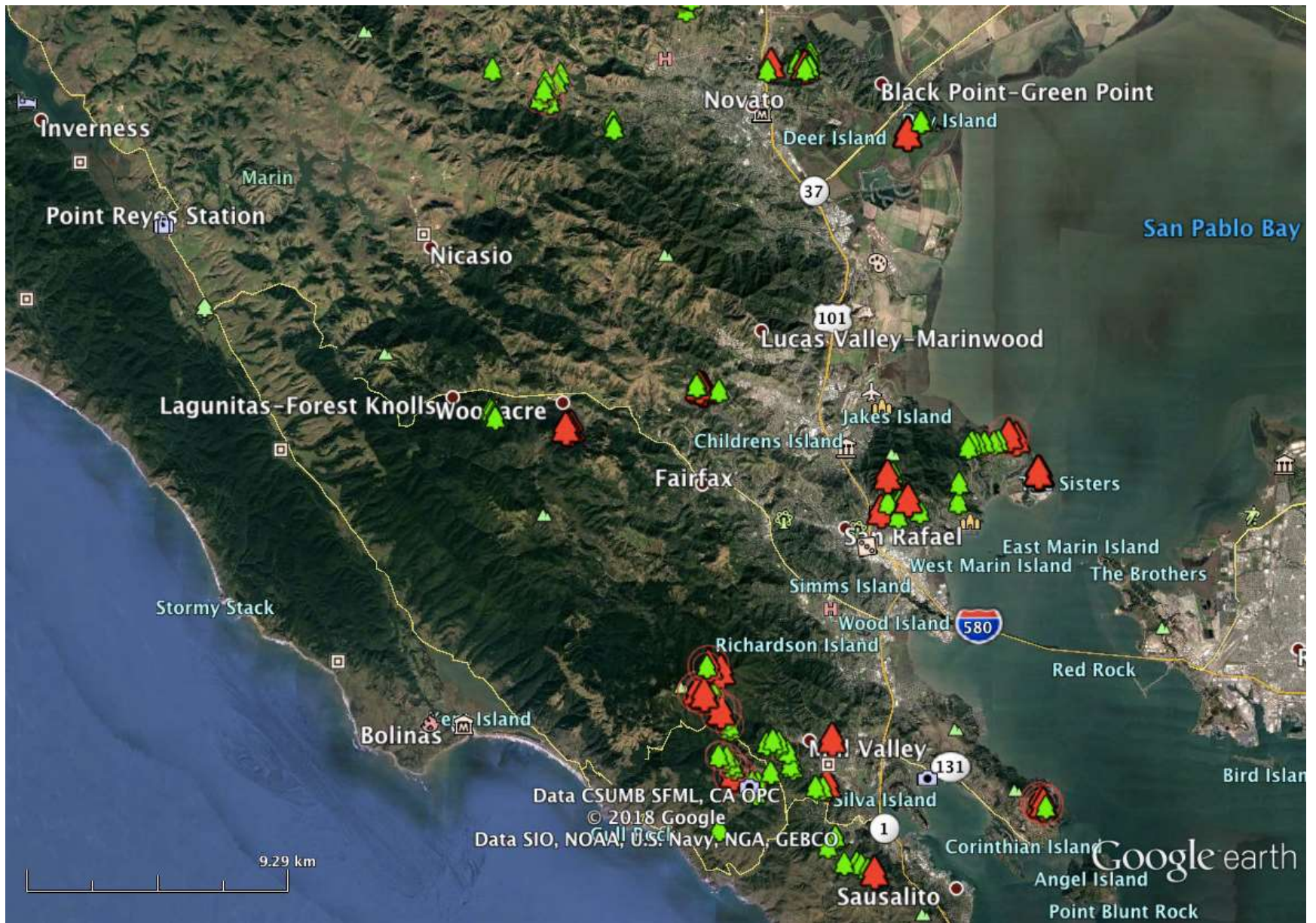


# Central and Southern Sonoma



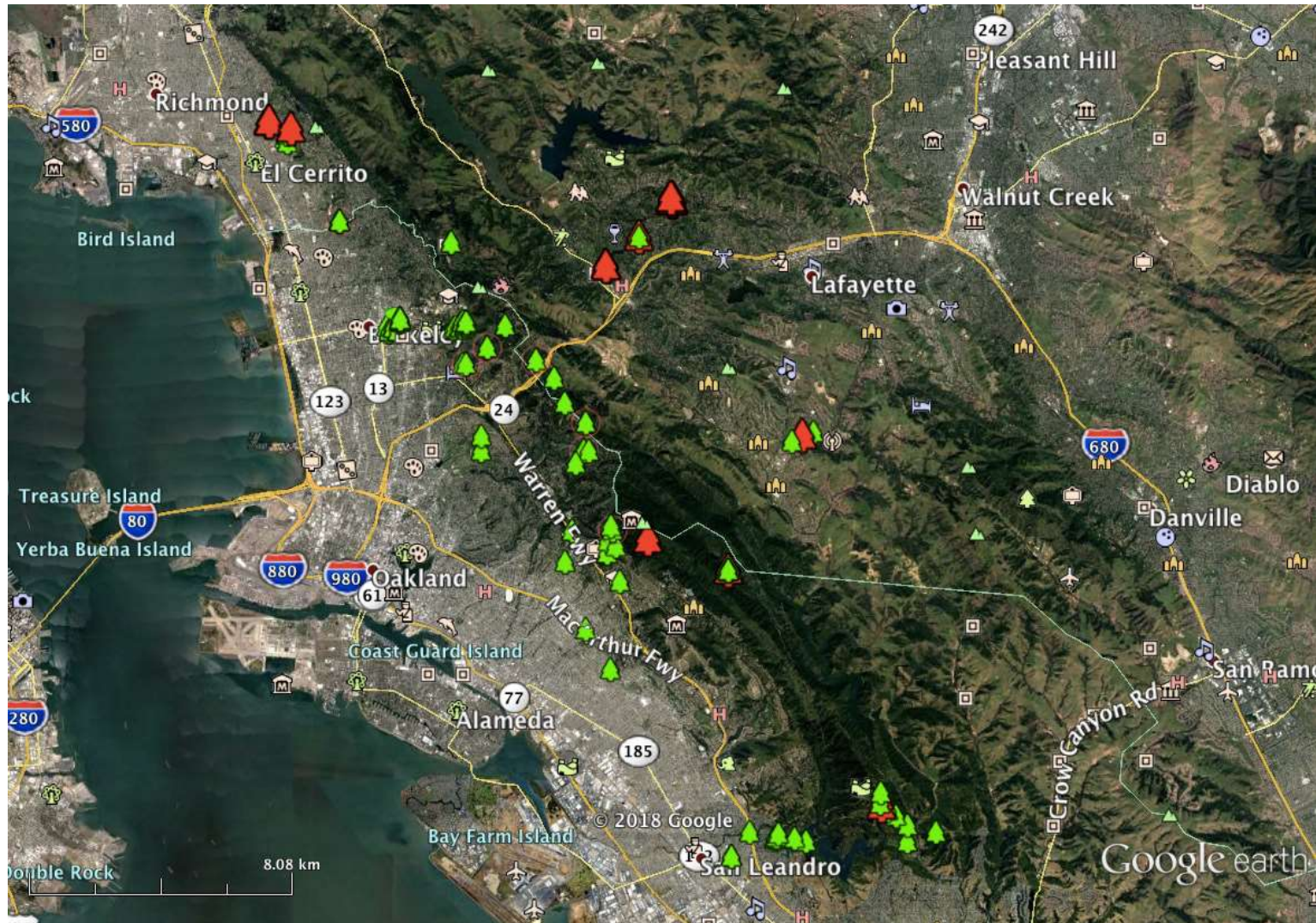


# Marin



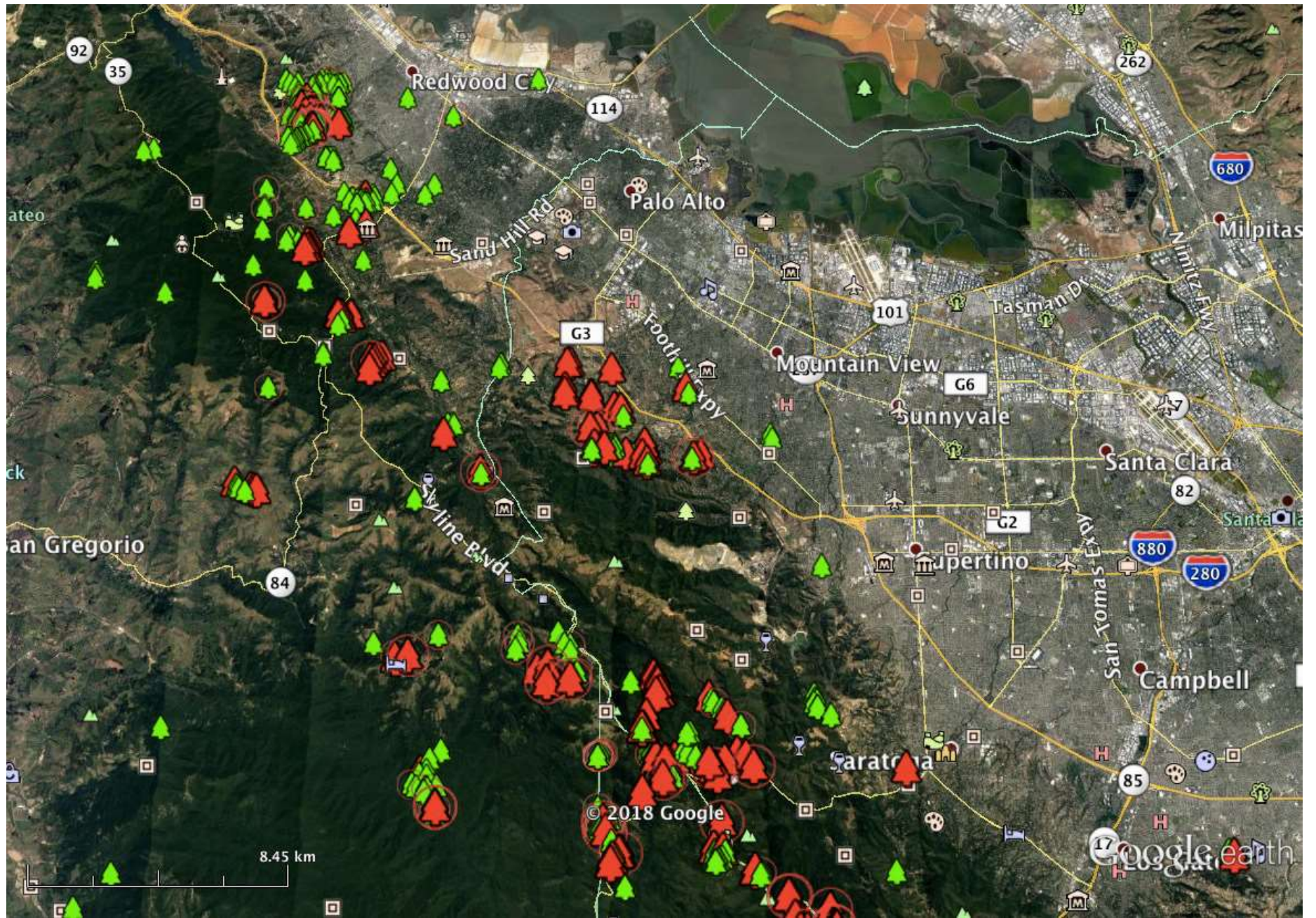


# East Bay



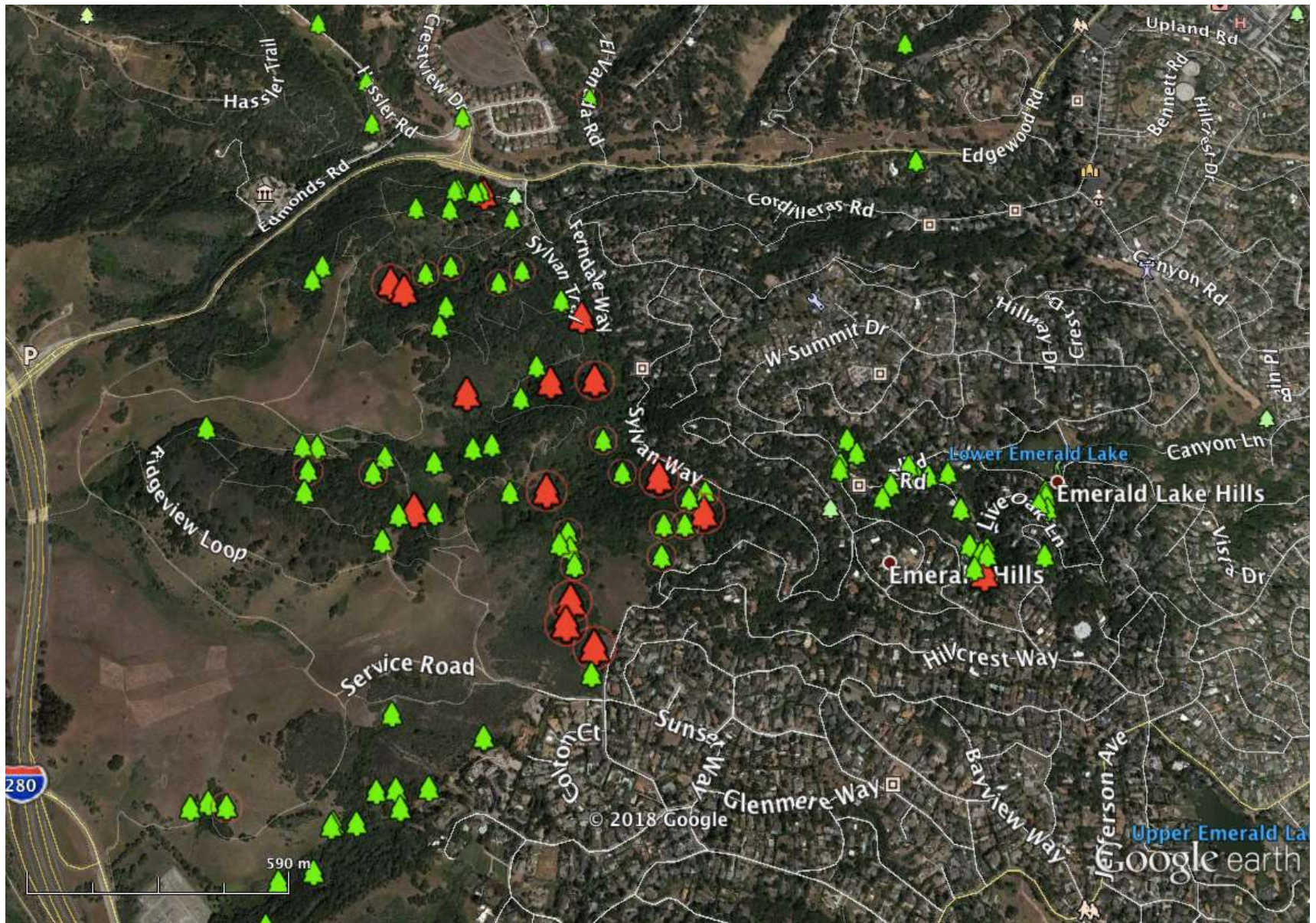


# SF Peninsula



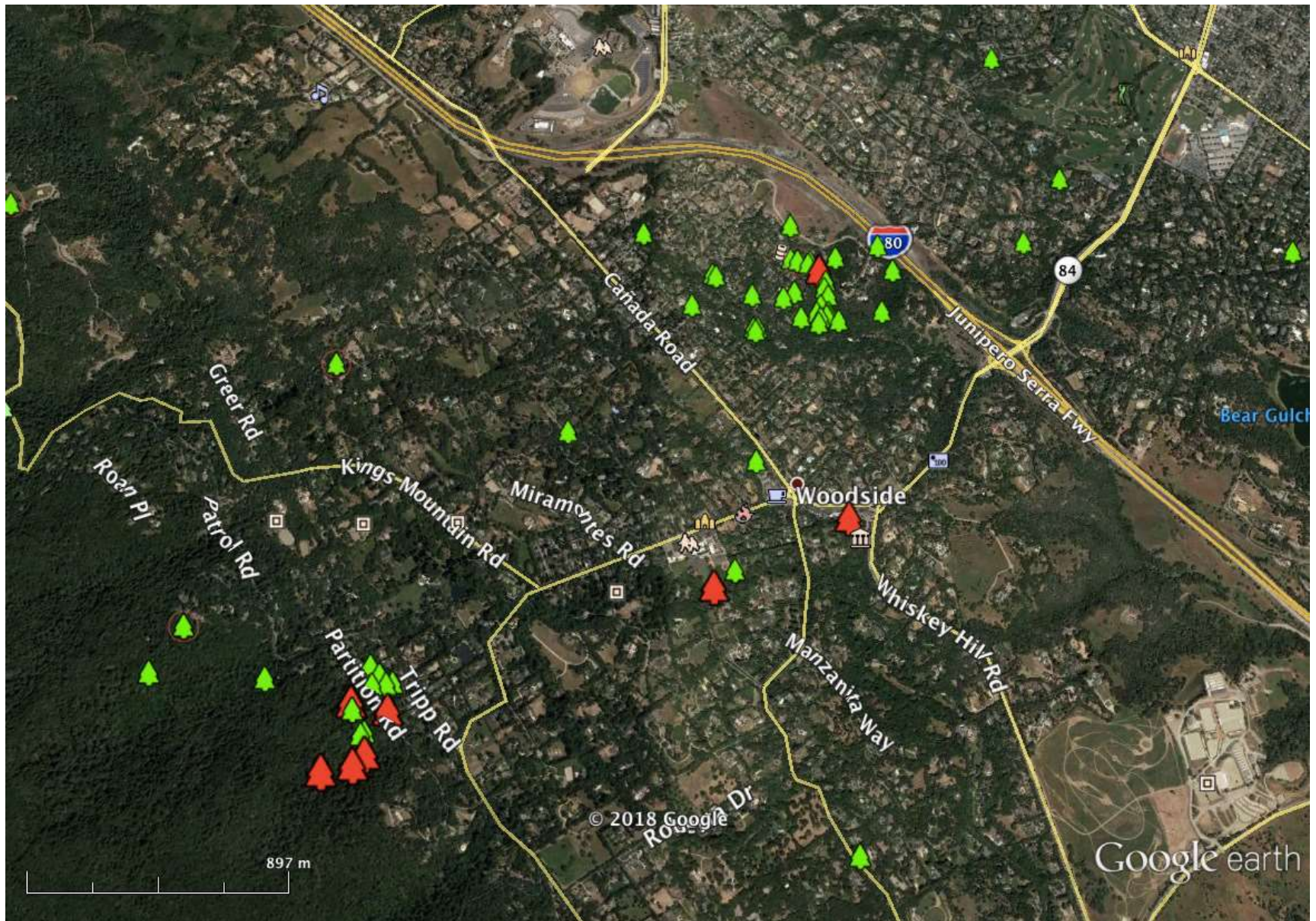


# SF Peninsula: Emerald Hills



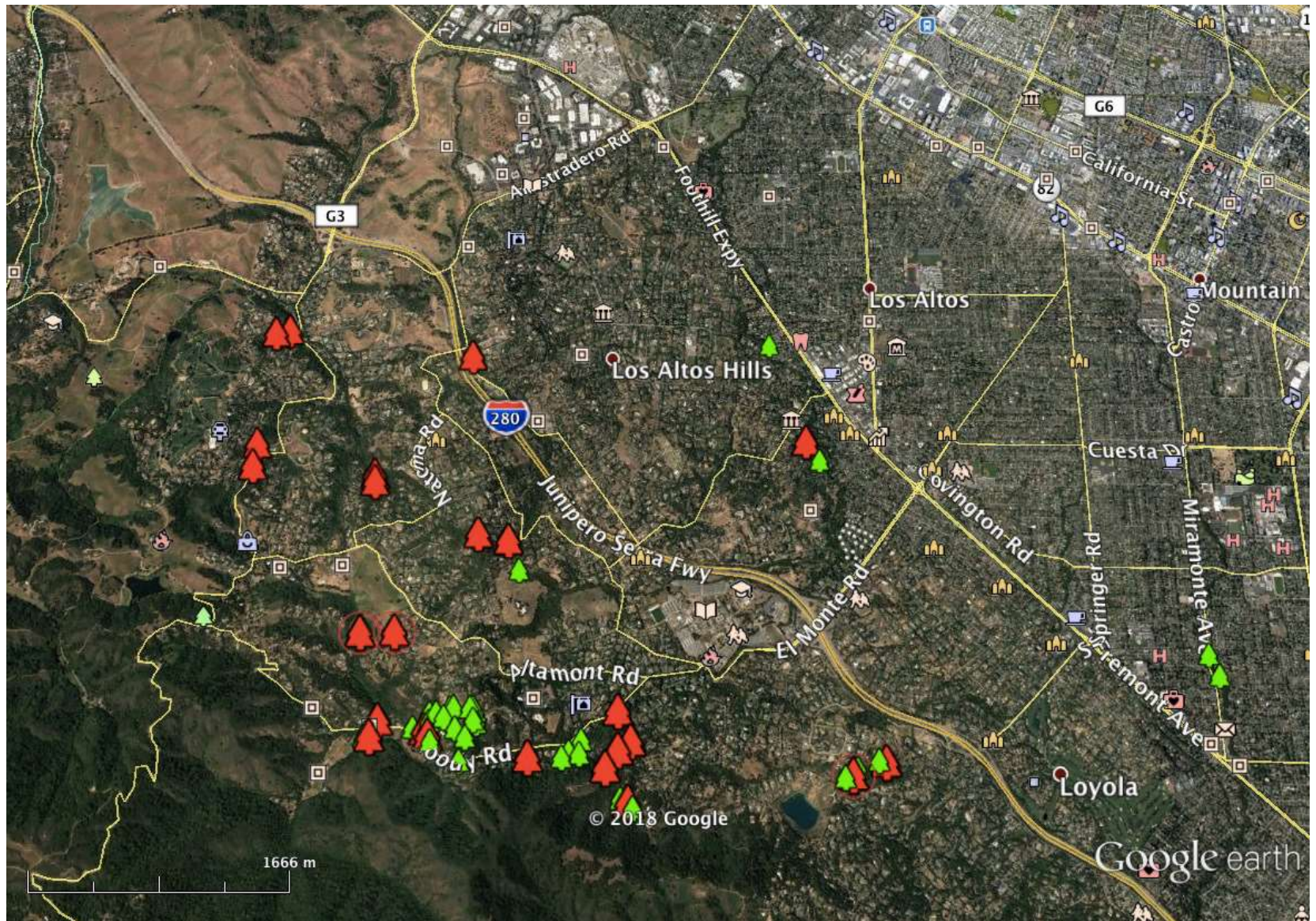


# SF Peninsula: Woodside



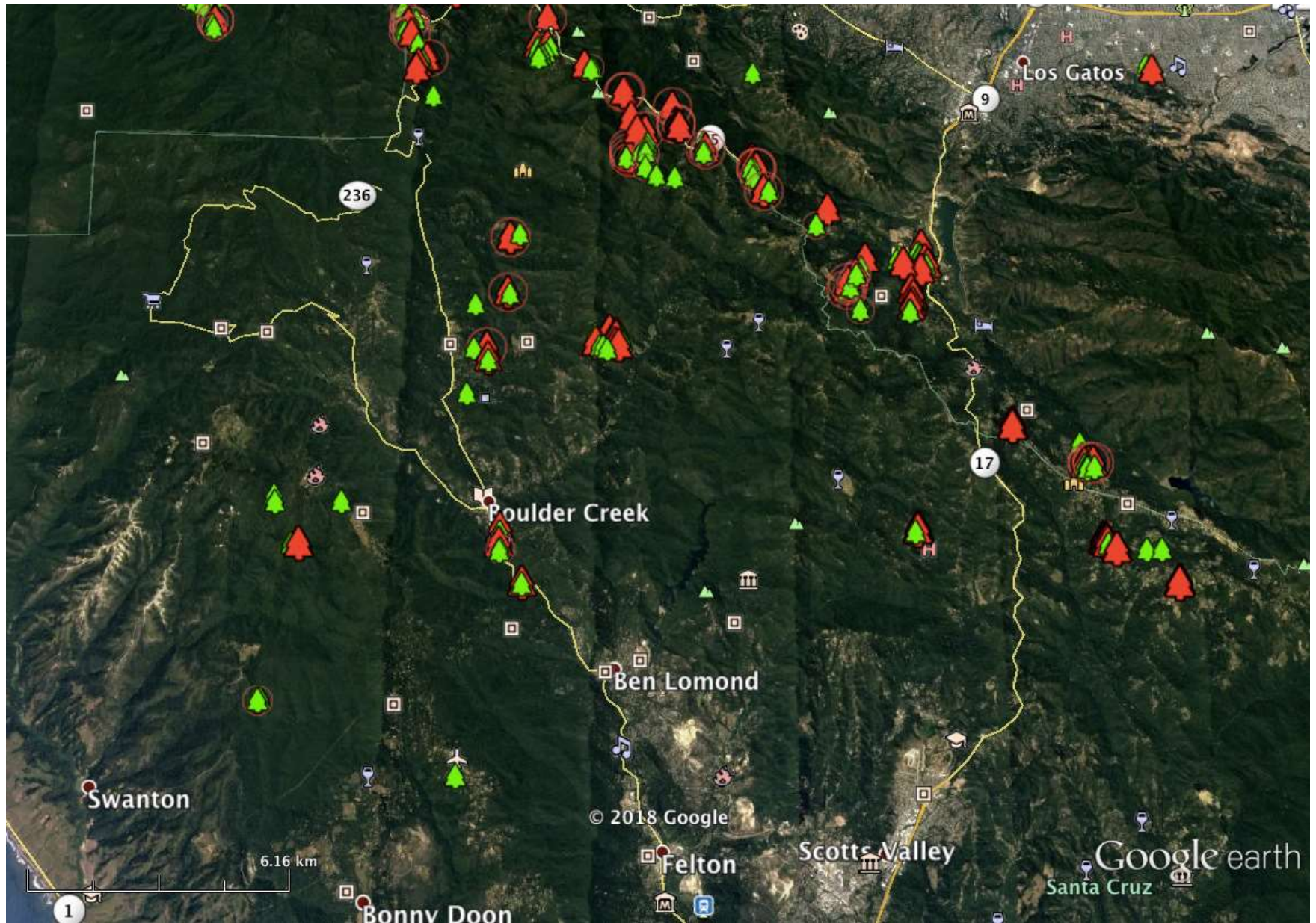


# SF Peninsula: Los Altos Hills



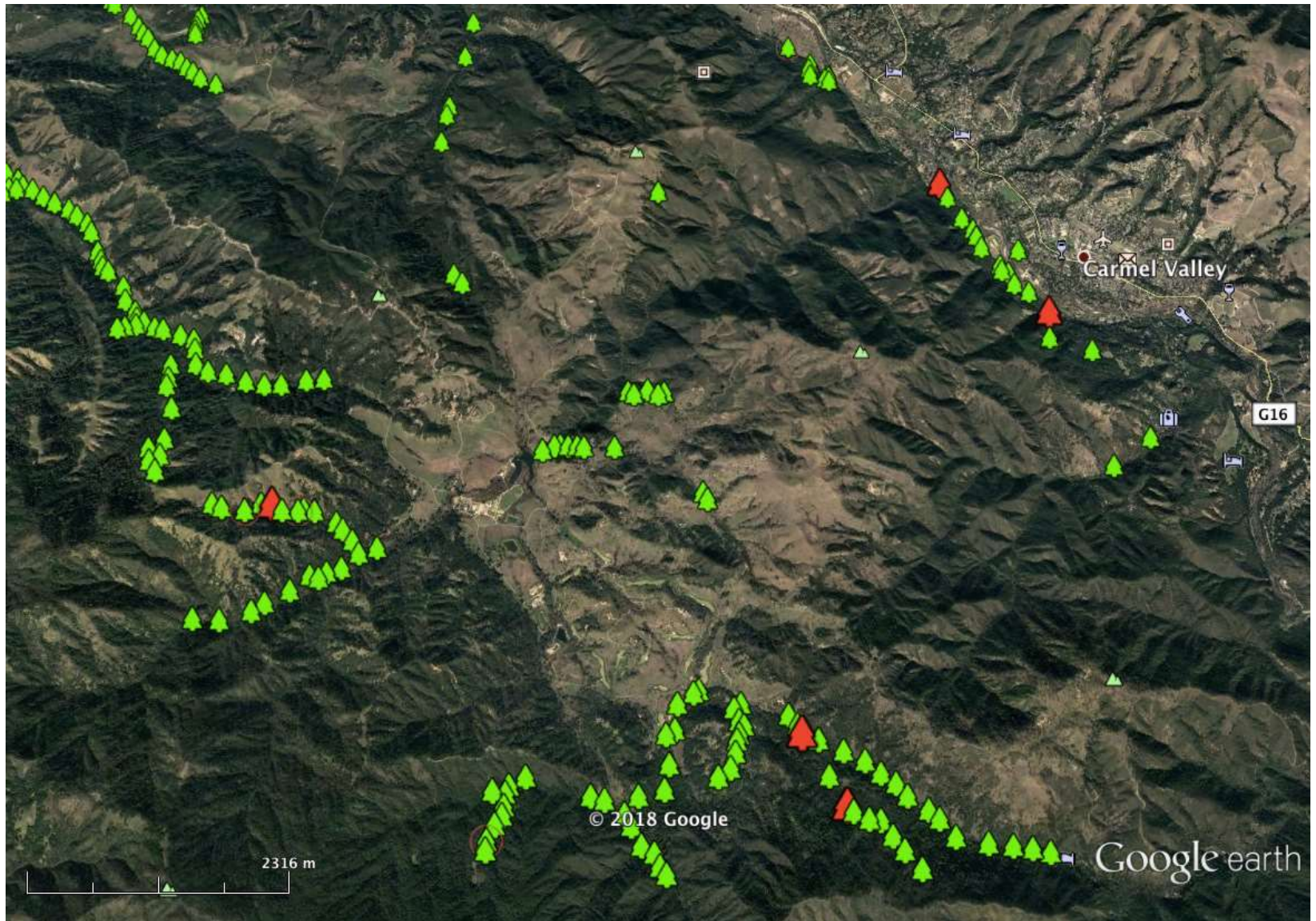


# Santa Cruz





# Carmel Valley & SLP

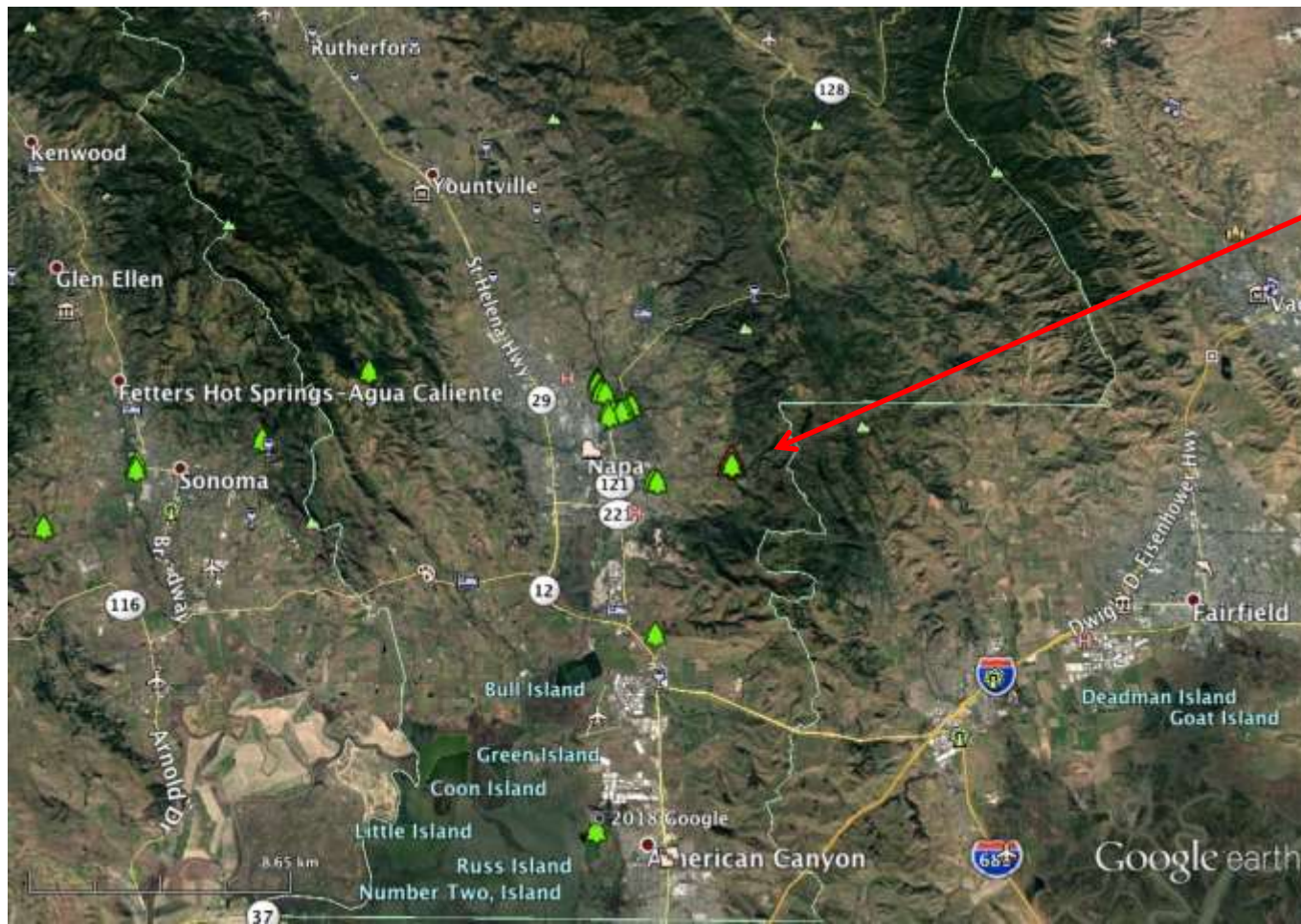




# Most Interesting Findings of 2018

## Blitzes-V

- Napa County: warmer weather does not seem very conducive to SOD



# Sudden Oak Death

New disease caused by an exotic pathogen introduced in CA in the late 80s probably from Asia through infested ornamental plants. Oaks are completely susceptible (up to 100% mortality)

Spreads by itself aurally by wind & rain during mild wet season (but only a few hundred yards )

Risk for oak infection only when pathogen is within 200 yards

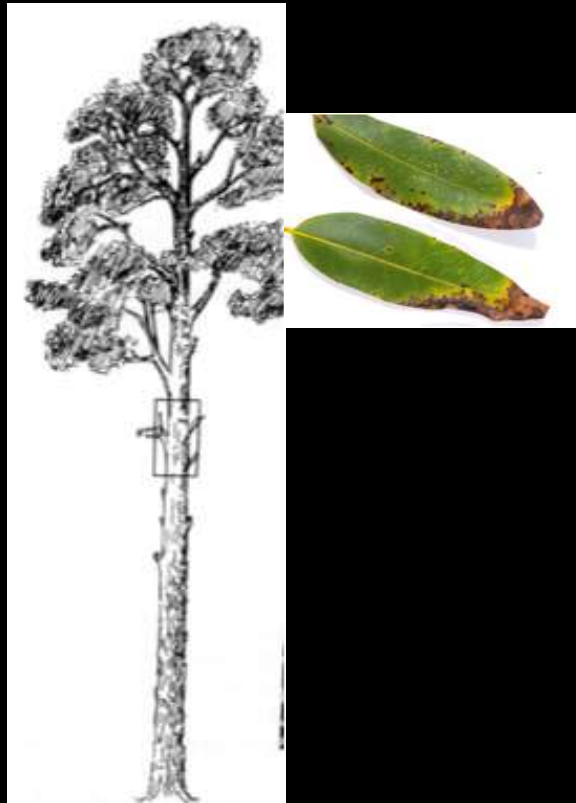
Need to have a fine-scale map of pathogen distribution





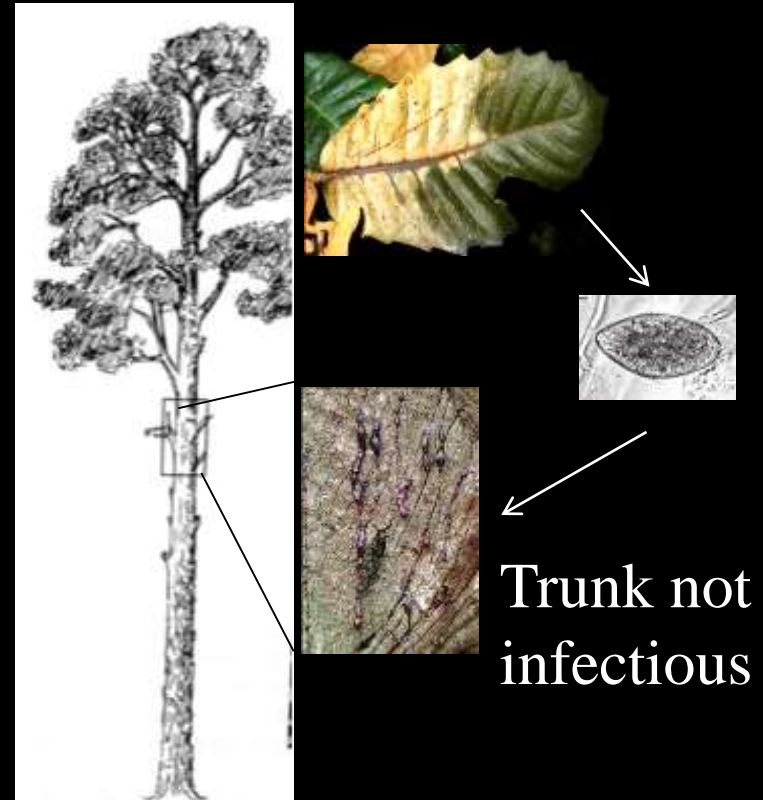
# Infectious hosts in CA forests

- CA Bay Laurel



Only leaves,  
highly infectious

- Tanoaks



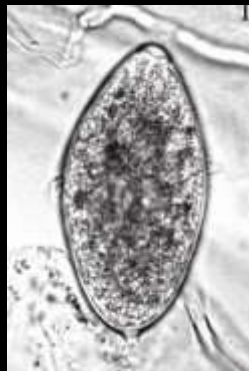
Leaves, petioles, twigs=infectious  
(Branches, trunks=not infectious)



# Bay/Oak association (not tanoak-oak)

Yearly, in spring, bay laurels

Coast Live Oak (no sporulation)



Wave years



Soil/Water

# More on bay-oak transmission

- Oaks and bay have to be within 60 feet
- Rainfall needs to be exceptionally high 6 weeks prior to infection (this has happened only in 2000/2001; 2005/2006; 2010/2011; 2017)
- Temperatures need to rise to 70 F for infection to occur. Early rain is too cold.

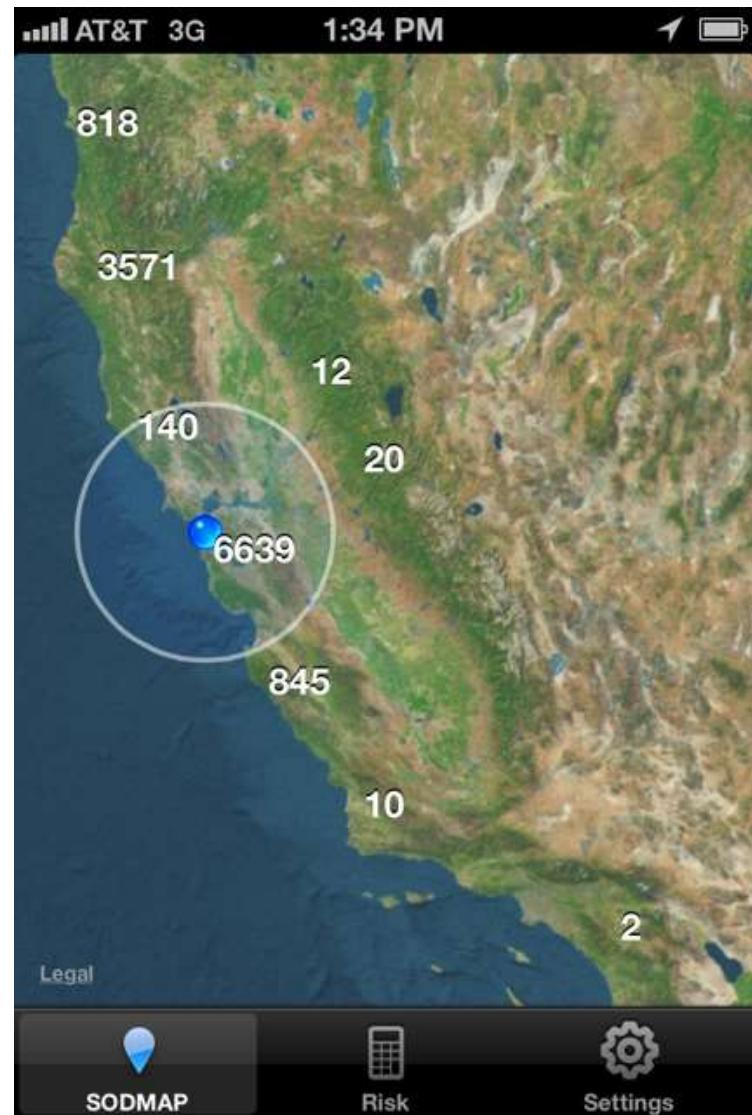
# Disease Management: 1<sup>st</sup> step

- Do I live in an area at risk for SOD?
- Are there California Bay Laurels and/or tanoaks where I live?
- Are my oak species:
  - California Coast Live Oak
  - California Black oak
  - Shreve's oak (Santa Cruz to Santa Barbara)
  - Canyon Live Oak
  - Tanoak

# SODmap Mobile:

SODMAP Mobile

U.C. Berkeley  
Forest Pathology  
and Mycology  
Laboratory





Enlarge screen view using your Index and thumb fingers

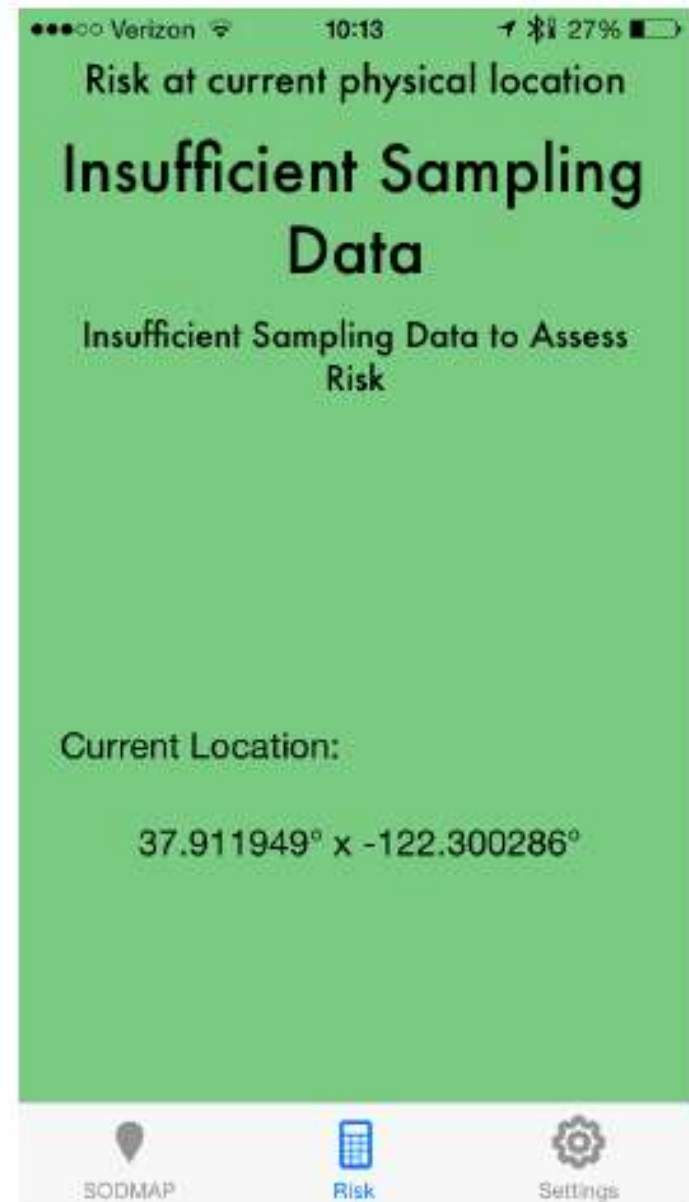


Red pins = SOD positive, tap to find out date and number

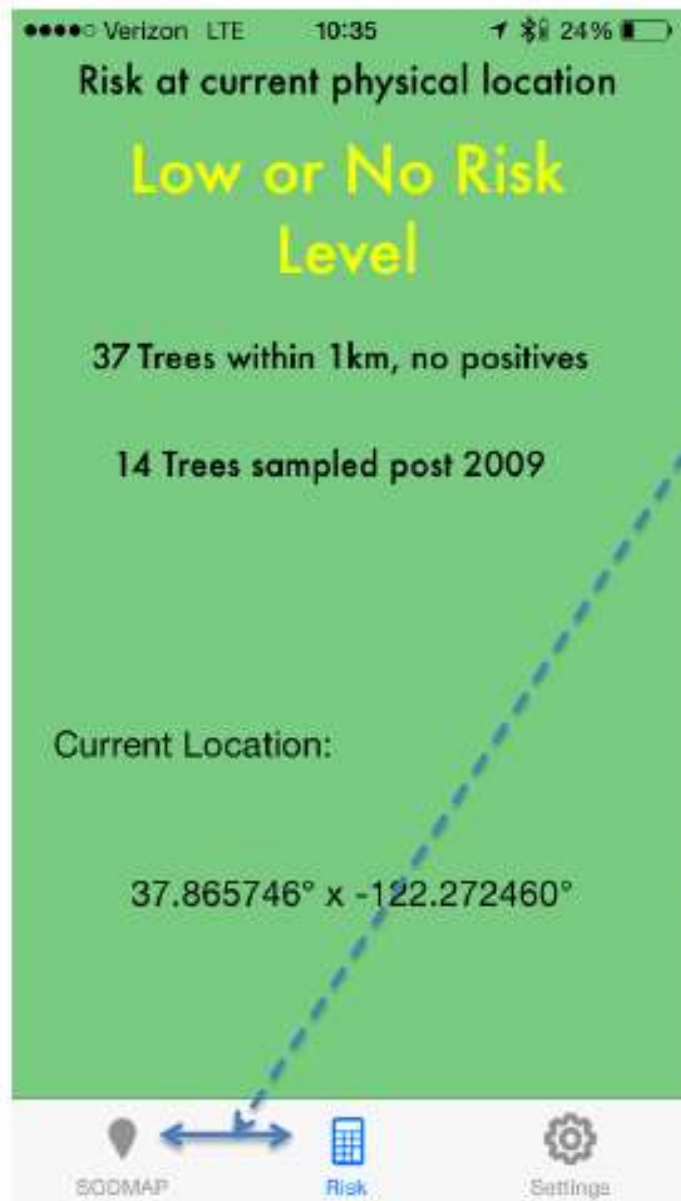




Tap on risk icon



Risk where you are physically standing



When assessing risk at a second location, remember to tap SODMAP button and then Risk button, in order to reset, otherwise you may get same warning as in the previous location

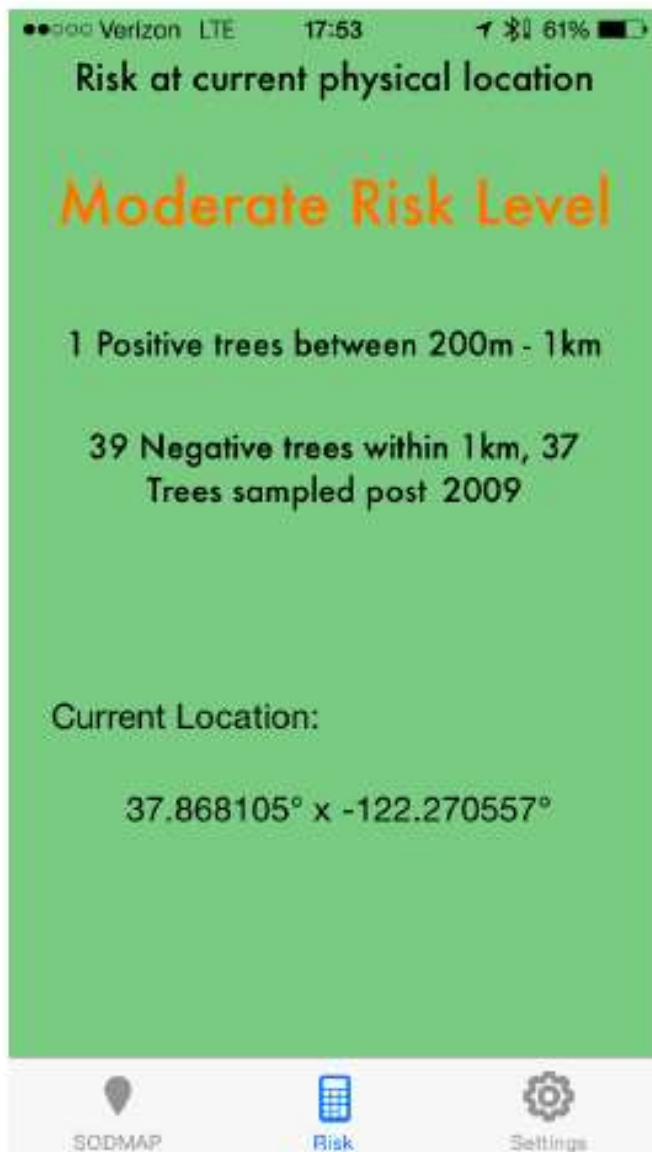
A two-digit number in this line gives you more confidence

Number > 4 in this line gives you more confidence

Precise location and coordinates of user: You can record if needed

Stay alert but no need to do anything





May want to do something



Urgent to do something if you have  
Oaks and bays growing together

# What to do and when to act

- Insufficient data or low risk
  - Keep monitoring your bay trees for infection, by participating in one of the many SOD blitzes in the Spring of each year. For info and details go to [www.sodblitz.org](http://www.sodblitz.org)
- Moderate or high risk
  - Do most of the significant yard work (e.g. pruning, grading, cutting dead trees) in the late summer or fall
  - Selectively remove “key” bay laurel trees in Summer and Fall
  - Apply a preventive phosphonate treatment to oaks at risk in the late Fall (after Halloween and before Xmas)

## 2<sup>nd</sup> What to do

- Oaks are infected by spores produced on leaves of California Bay laurels
  - Selectively remove bay laurels around high value oaks
  - Reduce overall bay density in property

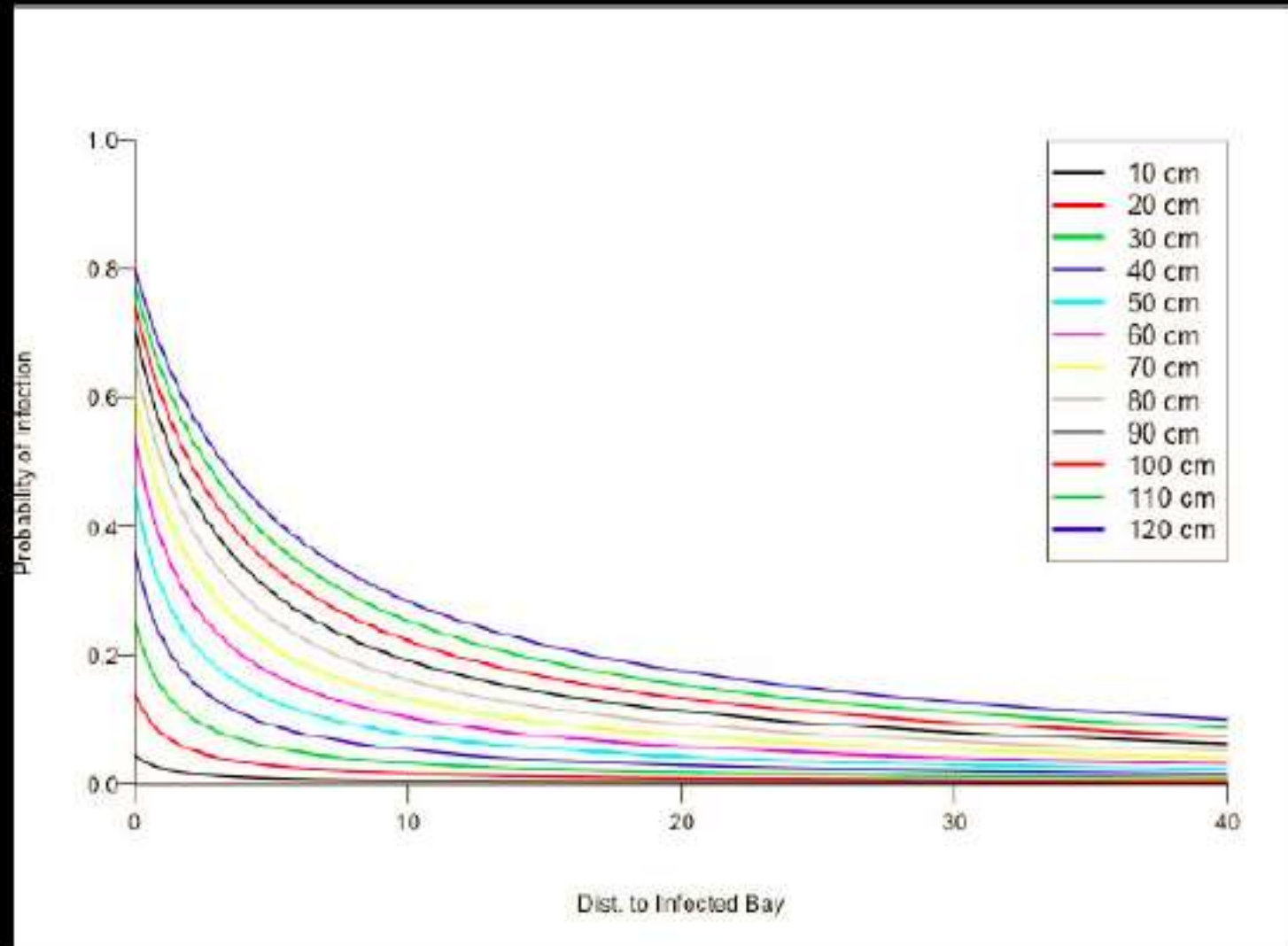
Symptomatic CA bay  
laurel



+ rainfall (over  
400 mm)= oak  
infection

## Probability of Oak infection is greatest for large oak nearest infected bays

NEW!!!



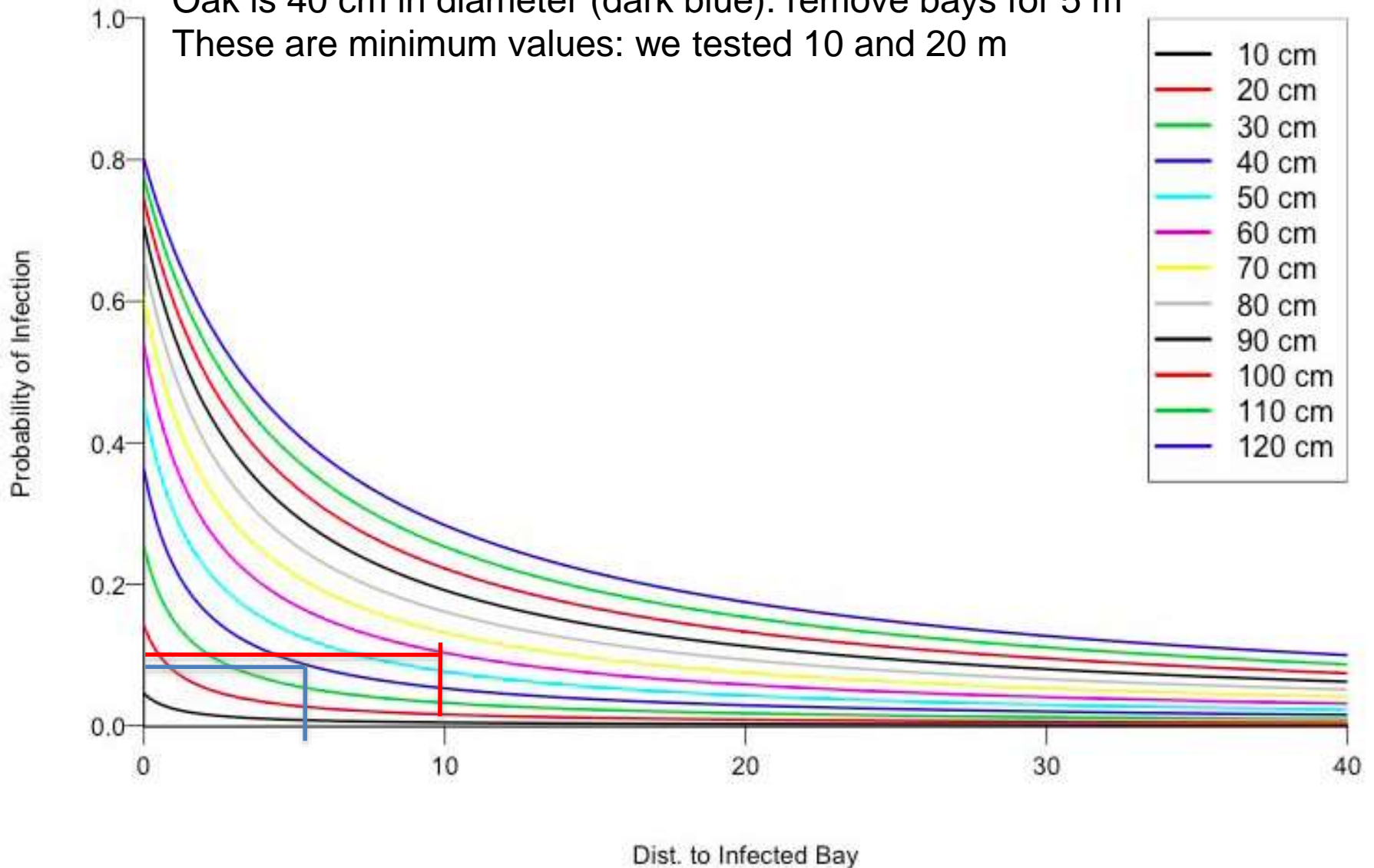
Choose line depending on size of your oak. Risk should be no more than 0.2. Draw horizontal line from 0.2 until it intersects the line you picked based on size of oak. Draw vertical line at intersection point. On x axis is the minimum buffer zone where you should remove bay laurels

Risk acceptable, varies subjectively, but lets say 10%

Oak is 60 cm in diameter (purple line): remove bays for 10 m

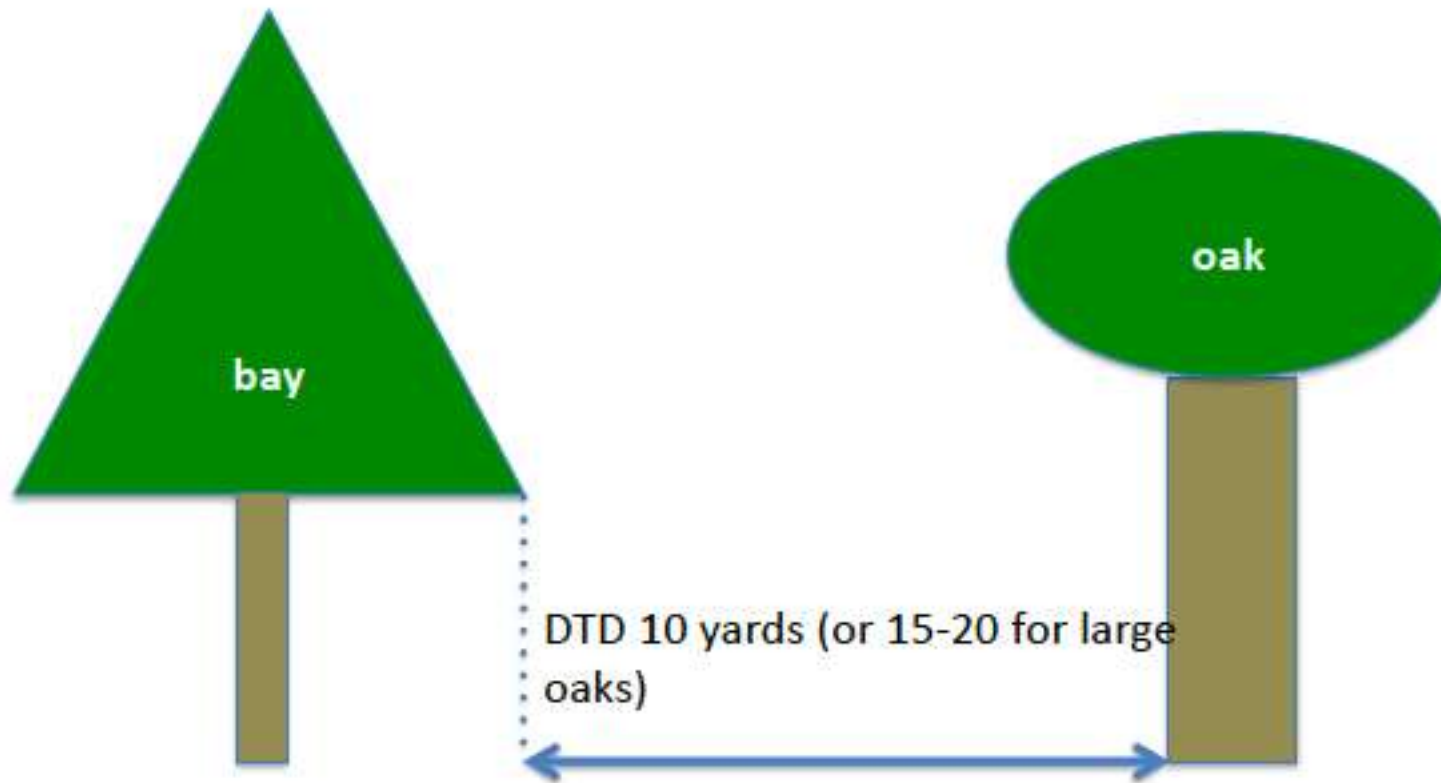
Oak is 40 cm in diameter (dark blue): remove bays for 5 m

These are minimum values: we tested 10 and 20 m





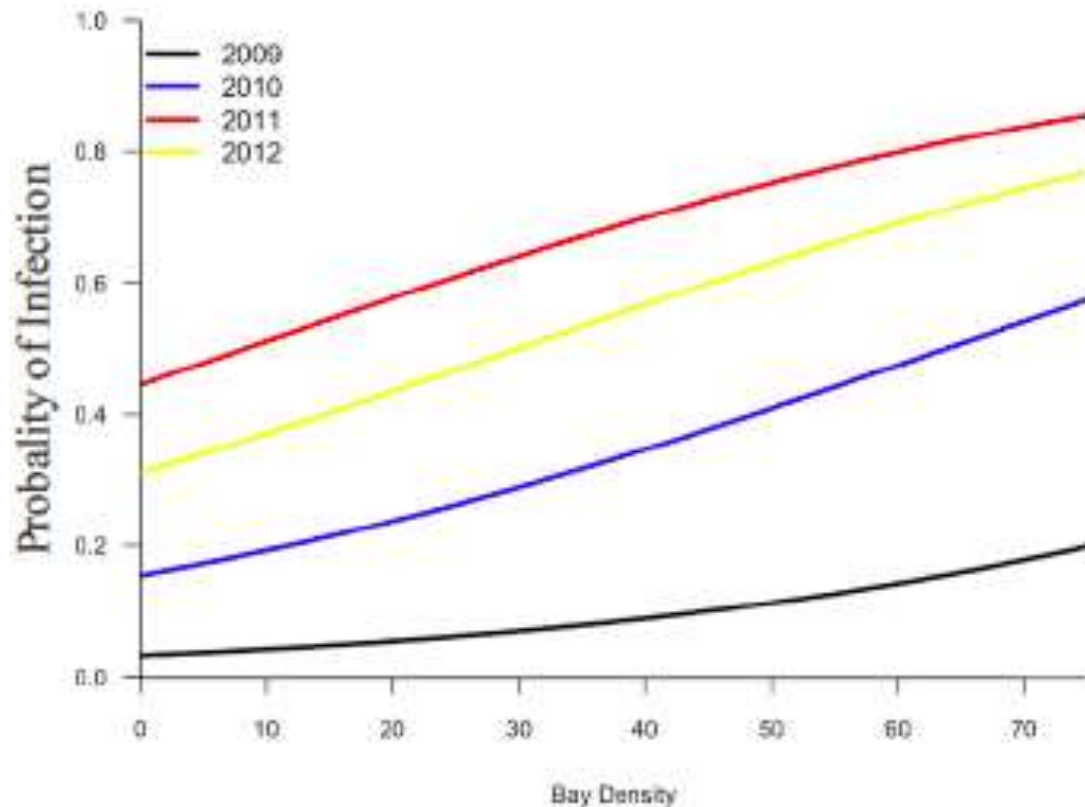
# Drip-line to trunk distance (DTD)



If on a slope, or bay is upwind, increase distance 10 or 20 %



Reducing overall bay density beneficial (red line  
infection rate when it rains a lot; black line  
infection levels when dry)



NEW!!!

# Which bays should I remove?

- Only up to 20 " diameter, only if slope not too steep, and only if tree further than 10 yards from a stream
- Remove bays whose canopy drip line is within 10 yards of oak trunk if oak diameter is 35" or less, for larger oaks try to remove bays in a buffer area up to 15-20 yards from oak trunk
- Remove bays that are SOD infected after long drought (i.e. SOD positive in 2014 blitz) if frequency of positives 20% or lower

# Preventive treatments with phosphites aka phosphonates (I)

- Water soluble, neutral pH, systemically absorbed by plant they increase natural defenses of trees. If dosage is right, no significant side effects
- Treatments need to be applied on healthy trees in areas with confirmed SOD between Halloween and Christmas



# Preventive treatments with phosphites aka phosphonates (II)

- Injections
- Multiple per tree but can use same injector
- Only diluted phosphonate
- Once every two years in Fall
- Trees of all sizes
- Bark application
- Need to combine with Pentrabrak
- Once every year (unless soil was amended with gypsum)
- Trees with DBH under 45 cm (20 inches)







Injectors using 40 mL and 35 PSI (Moderate Pressure)







20 mL and 20 PSI (low pressure)

# NEW!!!

Table 1. New recommended phosphonate injection dosages.

- Label Dose = 1 part chemical + 2 parts water = 1:3 delivered in 10ml dose (discontinued).
- Dilution #1 = 1 part chemical + 29 parts water = 1:30 delivered in 20ml dose (Chemjet injector).
- Dilution #2 = 1 part chemical + 59 parts water = 1:60 delivered in 40ml dose with higher pressure (Arborjet injector).

Treatment once every two years

# Injected Phosphonate Efficacy

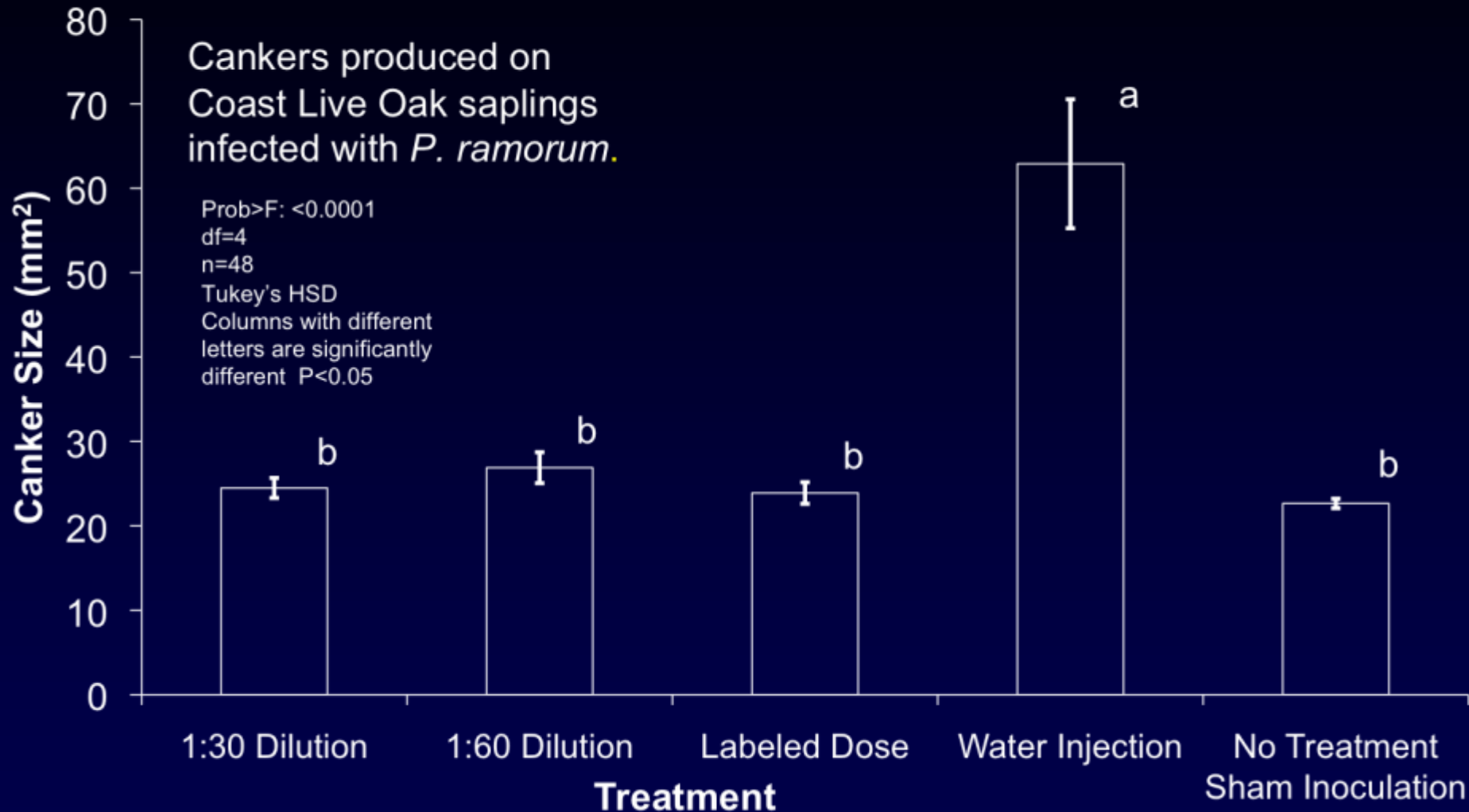


Figure 1. Efficacy of labeled dose vs updated dilution ratios. Smaller lesions = higher efficacy



# Phosphonate Damage to Wood

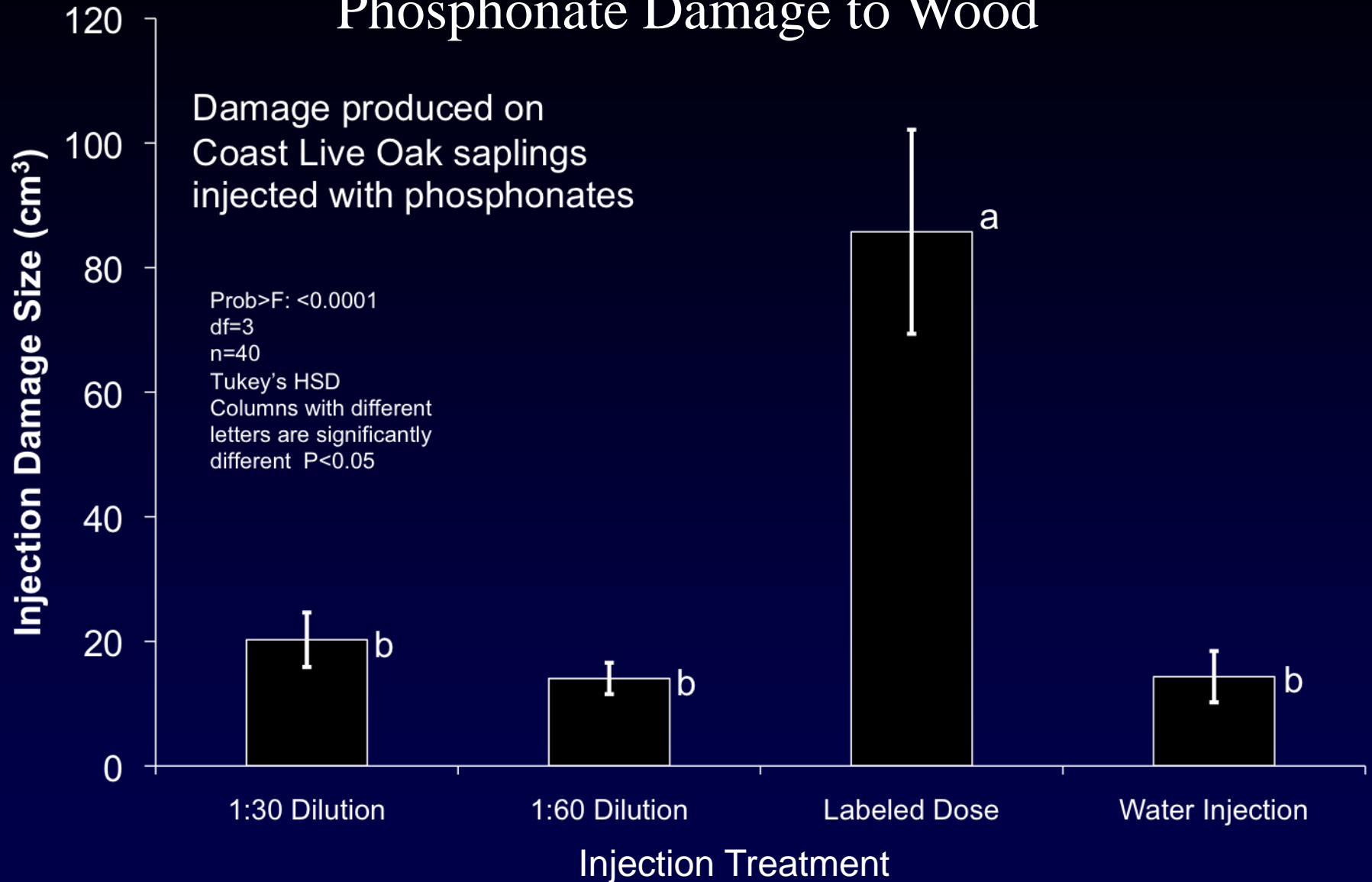


Figure 2. Injection damage caused by labeled dose vs updated dilution ratios. Note that updated dosage damage is indistinguishable from damage caused by only injecting water.

# AGRI-FOS®

SYSTEMIC FUNGICIDE



## PENTRA-BARK

BARK PENETRATING SURFACTANT



Topical Treatment



## Application Protocol Pt. 2

Injection treatments require additional equipment in the form of spring-loaded, hydraulic, or air pressure injectors that maintain a positive pressure required for introducing the diluted product into the tree. The injections are made through holes drilled into the trunk and use relatively small amount of chemical usually about 50-200ml (1.5 – 7oz), to treat a tree.

The topical application, on the other hand, uses commonly available liquid spray equipment and does not leave holes in the tree. The topical method however requires considerably more product (2-15L, 0.5-4gal) and overspray may damage surrounding vegetation, including moss and lichens.



# Phosphonate Application Materials and Supplies



# NEW

- Injection dosages changed, one injection every two years between Halloween and Christmas
- Topical treatment unchanged, one treatment in the Fall each year, but with Gypsum amendment one topical treatment every two years may be reasonable
- Soil amendment with Gypsum highly recommended but only if treating with phosphites and in soil that are not too rich in calcium

# Gypsum amendments

(Anhydrous Calcium Sulfate)



About 3 feet around trunk

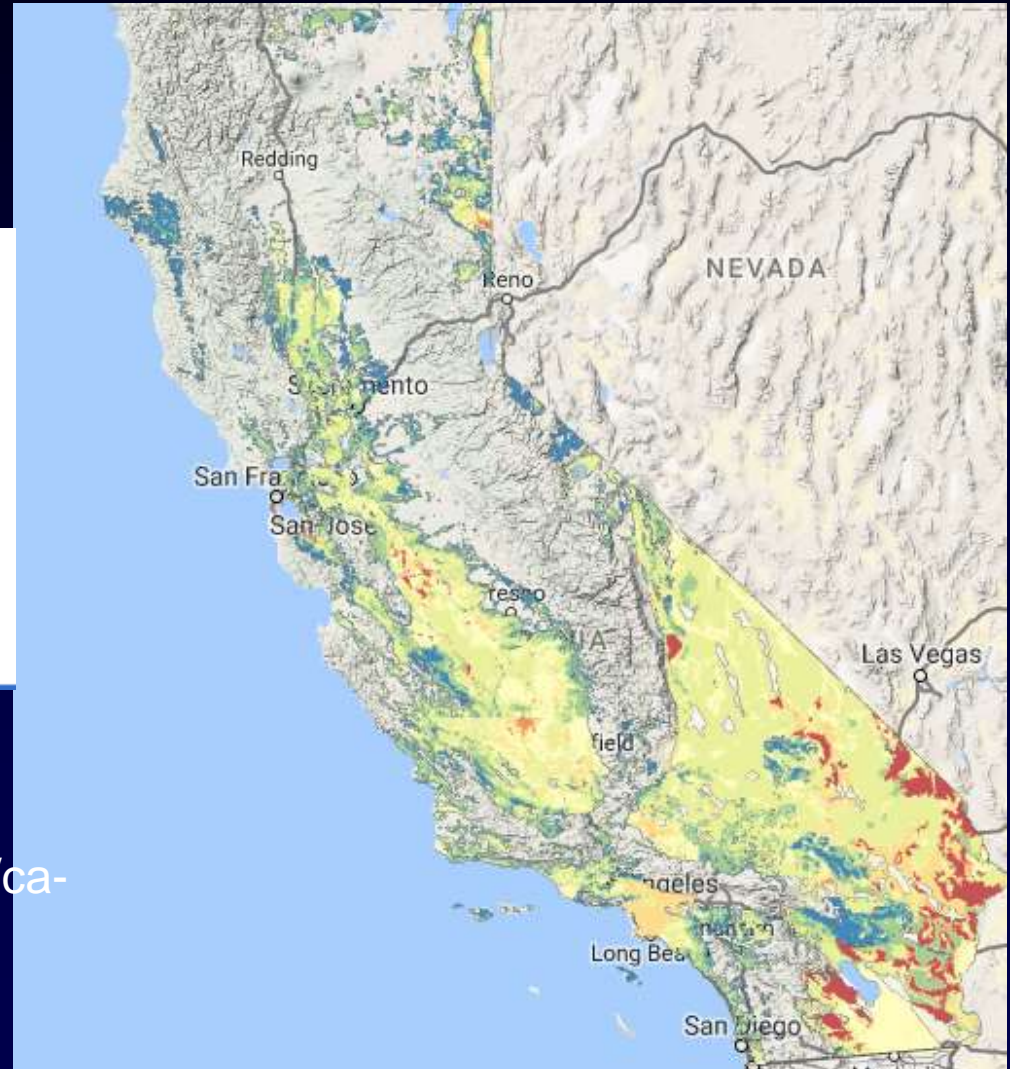
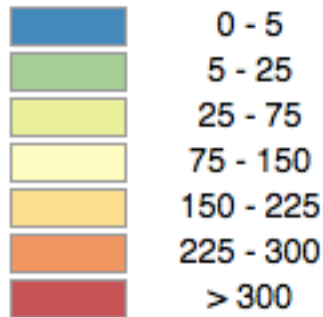
- 3-5 lbs of granular Gypsum per tree, depending on tree size
- Mix with top layer, in an area with radius of about 3 feet around trunk
- Apply possibly one two two weeks before phosphonate treatment, or at the latest at the same time as treatment
- Increases efficiency of both injections and bark treatments
- Bark treatments plus gypsum can be applied once every two years rather than yearly



# Gypsum amendment OK if color is not yellow to red

## Calcium Carbonate ?

$\text{CaCO}_3$  (kg/m<sup>2</sup>)



<https://casoilresource.lawr.ucdavis.edu/ca-soil-properties/>

# SCRIBING

- Can we excise cankers from oaks stems, if we catch them early on
  - Run experiment during dry 2012-2014 period in 3 sites
  - Results show that during drought 75% of oaks are not easily infected
  - Using the remaining 25% we can say with strong statistical support that:

- *P. ramorum* was detected in an equal number of scribed vs. non scribed trees
- Positive, yes *P. ram* DNA
- Negative, no *P. ram* DNA
- Summary

n=68

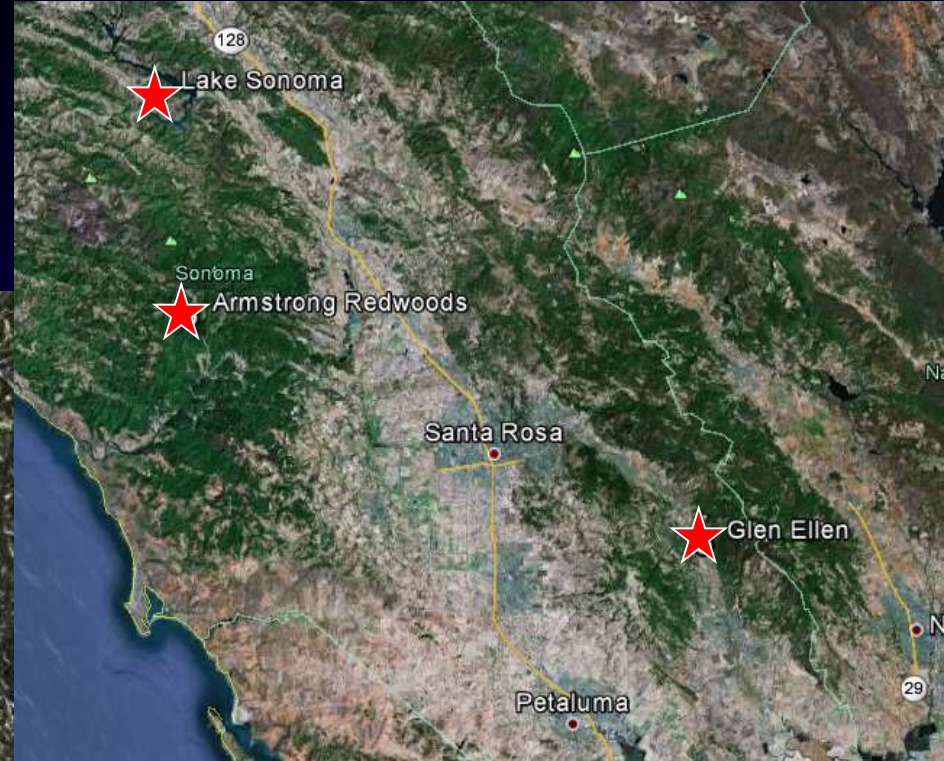
Scribing positives= 14; negatives 54

Untreated positives= 12; negatives 56

P=0.66



# SOD Canker Scribing Experiments





Positive control (infected but not scribed) lesion

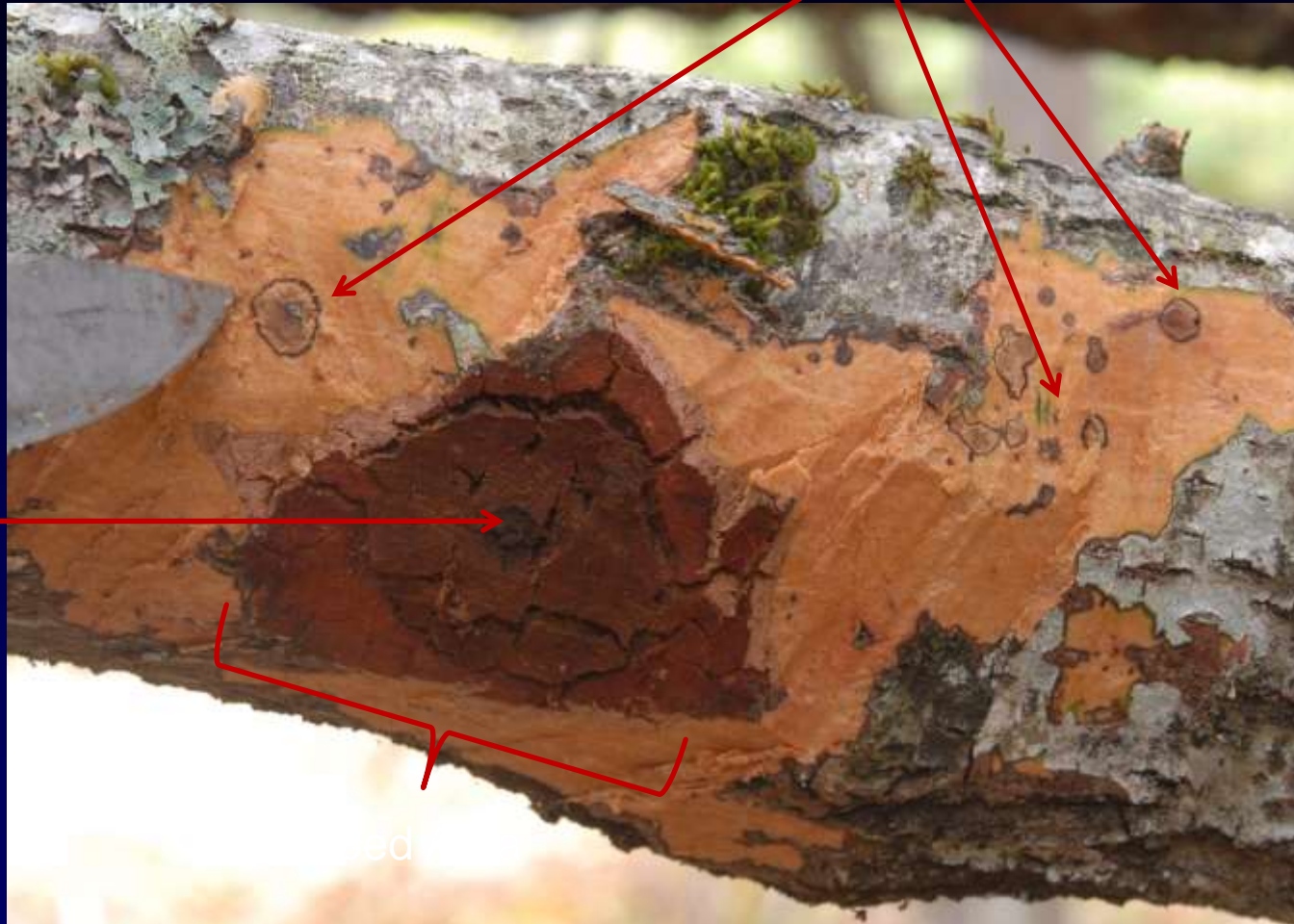


Infected/scribed lesion

New lesions outside scribed area ? Maybe

≈ 1cm

Initial  
infection  
site





# Scribing

- Based on our results we cannot recommend scribing

# Final additional recommendations

- Green waste and live infected plants the most dangerous ways to spread SOD
- Tools not very effective in spreading SOD: however if tool looks clean then SOD will not be spread
- Mulch could harbor SOD, fine grain commercial compost does not harbor it
- Dead trees or plants: grind and disperse locally: do not pile or cover. Infected material needs to dry fast

- [www.TreeFAQs.org](http://www.TreeFAQs.org)
- Tree Health Answers & Questions
- Good or new questions are published and help create a database of important issues in CA

**UC BERKELEY FOREST PATHOLOGY AND MYCOLOGY LAB**

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## THANQs – FAQ

### Tree Health Answers & Questions

Ask the experts any questions about tree health, diseases, or management...

#### General Tree Care

[When should I remove a tree?](#)  
[What is the Critical Root Zone around a tree?](#)

#### Oak Tree Care

[How many kinds of oaks are there in California?](#)  
[What's the Gold Spotted Oak Borer?](#)  
[What can I plant under my oaks?](#)  
[I have insect larvae in my oak acorns, what do I do?](#)  
[Should I water my oak trees during the drought?](#)

#### Sudden Oak Death

[How can I tell if my trees have SOD?](#)  
[Are there any treatments for SOD?](#)  
[Are there any SOD meetings or workshops?](#)  
[How can I get my trees tested for SOD?](#)


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**Featured**




**SOD: Cleaning Tools & Equipment**




**What is Sudden Oak Death?**



**Wood Decay Diagnostic**



**SOD Treatments**



**Fun with Fungi: Mycology Careers**



# Important URLs

- [Matteolab.org](http://Matteolab.org)
- [Suddenoakdeath.org](http://Suddenoakdeath.org)
- [Sodblitz.org](http://Sodblitz.org)
- [Sodmap.org](http://Sodmap.org)
- [Treefaqs.org](http://Treefaqs.org)

# Drought and oaks

- Water deficiency due to prolonged diminished precipitation and increasing temperatures
- Physiological changes:
  - Direct effects such as thinner canopy, leaf abscission, stunted growth
  - Indirect effects: secondary pathogens and pests
- Some effects reversible: direct physiological changes, branch and foliage issues, stem decay
- Some effects irreversible: stem issues, some root rots



Stunted growth



Fungal twig dieback  
*Cryptocline*



Fungal branch dieback  
*Diplodia*



Stem cankers & terminal  
secondary decay fungi



Twig girdlers *Agrilus*  
Foliar insects, oak pit scale



Trunk insects &  
associated fungi



Root rots, *Armillaria*  
Soilborne Phytophthoras



Canker rots, *Hymenochaeta*



# Managing drought (I, short term))

- Ameliorate conditions to avoid onsite of irreversible symptoms, normally done during drought:
  - Place ground cover around (not on) tree base to lower evaporation and increase absorption
  - In case of prolonged drought and onsite of symptoms, water deeply (12 inches) once a month, November to June, only
  - Within a tree species, there is variable resistance to drought among individuals this is both genetic and site dependent. Learn to speak “tree”, to understand which ones need help
  - When irreversible symptoms are obvious; there is nothing you can do except for making sure windthrows will not cause damages or fatalities

# Managing drought (ii, Long Term)

- South aspect, shallow sandy or rocky soils, midslope are most impacted by drought
- Maintain a density appropriate for the site: thin, thin, thin: but do so before or after drought
- Make sure canopy is pruned back, important when trees are isolated or in low density stands
- When landscaping, avoid planting under trees. Also when making compositions use species with comparable drought resistance
- Individual trees growing in drier sites are more drought tolerant: saplings growing in these sites may be more drought tolerant.