SOD BLITZes 2024: Results & New SOD Management Recommendations

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UNIVERSITY OF CALIFORNIA, BERKELEY

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  - **State and Private Forestry: Phil Cannon**

- Mid Pen Open Space

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Sudden Oak Death

- Caused by the exotic pathogen *Phytophthora ramorum* introduced on infected ornamental plants in the 1980s
- Three genetically distinct variants (lineages) exist in North American ornamental plants (NA1, NA2, EU1)

- Since the 1990s the NA1 lineage has caused the mortality of tens of millions of oak species and of the related tanoak, but the disease affects a large number of native plants, some already threatened
  - Loss of native biodiversity, extirpation of entire tree populations
  - Declining and dead trees worsen fire hazard
  - SOD infected trees are at high risk of failing
  - Compromises the California Carbon offset program
  - Loss for native Californians
  - Loss of landscape trees
  - One of the worst tree epidemic in the world

SOD Blitz Survey 2024: some statistics

- A total of 28 Blitzes from Oregon border to San Luis Obispo

- Del Norte (Oregon border) the Northernmost
- San Luis Obispo (Santa Barbara border), Southernmost

- 294 collectors, (was 233 in 2023)
- 515 participants (was 408 in 2023)

- Trees surveyed: 23,644 (was 10,291 in 2023)
- Trees sampled: 1,848 (was 1901 in 2023)

- Statewide Rate of Positive trees: 17.2% (was 8.8% in 2023)
- Statewide True Infection rate: 5.7% (was 2.7% in 2023)
- Oak mortality/symptoms: 11.5% (was 11.8% in 2023)

SURVEY RESULTS

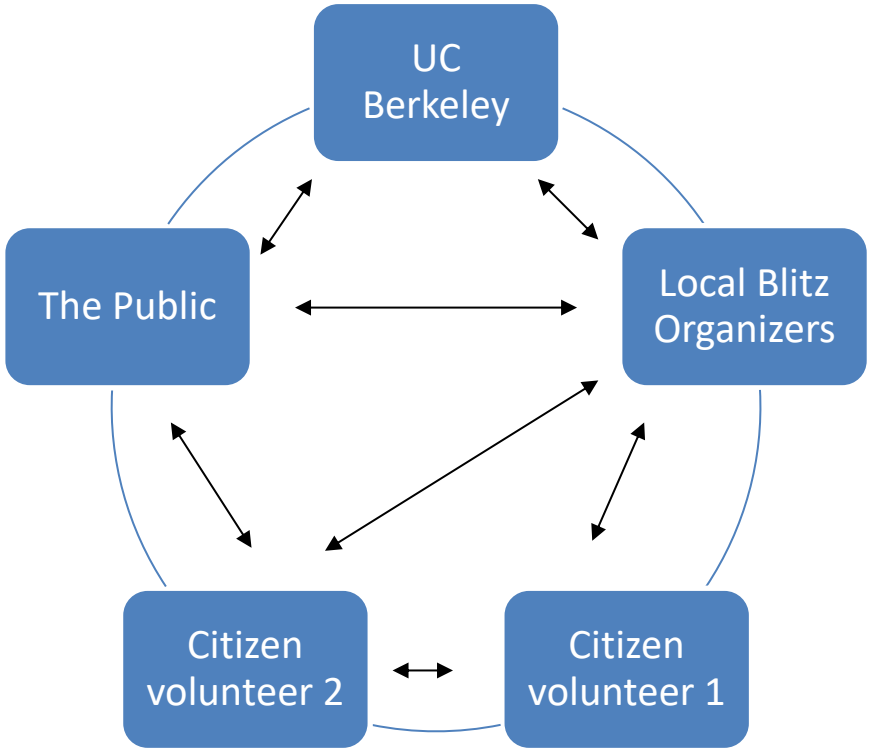
2024	2023	2022	2021	2020	Survey Question
3.1 ± 1.1	3.1 ± 1.0	3.4 ± 1.0	3.2 ± 0.9	3.1 ± 1.0	What do you consider your knowledge level to be on Sudden Oak Death (SOD)? (1-Low - 5-High)
4.3 ± 0.8	4.4 ± 0.8	4.5 ± 0.7	4.5 ± 0.7	4.3 ± 0.7	How do you rate the overall quality of this SOD Blitz meeting and of the presentation? (1-Low - 5-High)
4.1 ± 1.1	3.9 ± 1.1	3.8 ± 1.4	4.3 ± 1.1	4.0 ± 1.1	Are you likely to take action if the SOD Blitz shows there are infected trees in your neighborhood? (1-Low - 5-High)

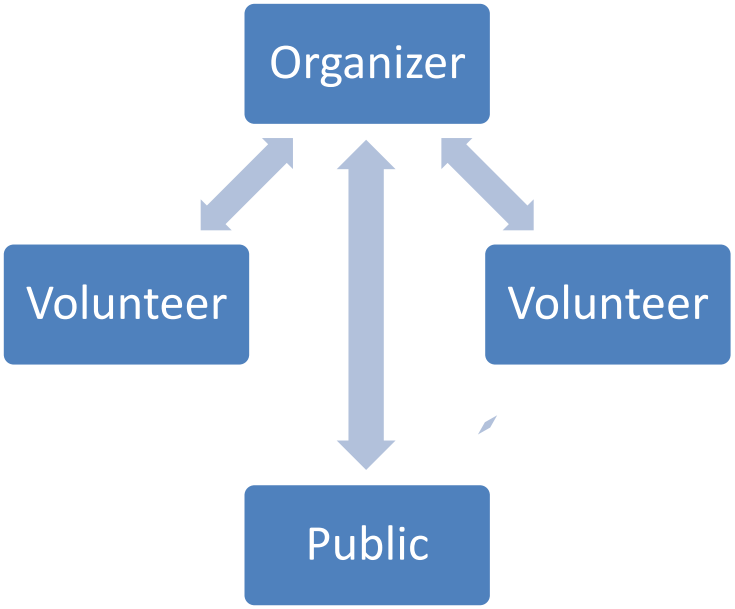
2024	2023	2022	2021	2020	Number of years participating in the SOD Blitz survey
50.9	68.5	65.2	74.1	54	% of participant newcomers
4.9	5.6	13.5	8.3	9.0	% participating for > 3 years
20.6	8.3	12.4	11.0	10.0	% participating for > 5 years

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 on the SODblitz map**
- Mid Fall, Blitz results added to SODmap andto Calinvasives
- SODmap mobile accesses data from SODmap :
  - App allows to identify sampled trees in the field
  - App calculates risk for oak infection at any location

SOD Blitzes vs. Other





Sodblitz.org

- Summary table of 2023 SOD Blitzes (you can turn on previous years' data on sidebar)

- Google Earth map of 2023 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)

SODmap mobile

- Video that shows how to use the APP **SODmap mobile**

Calinvasives by Calflora

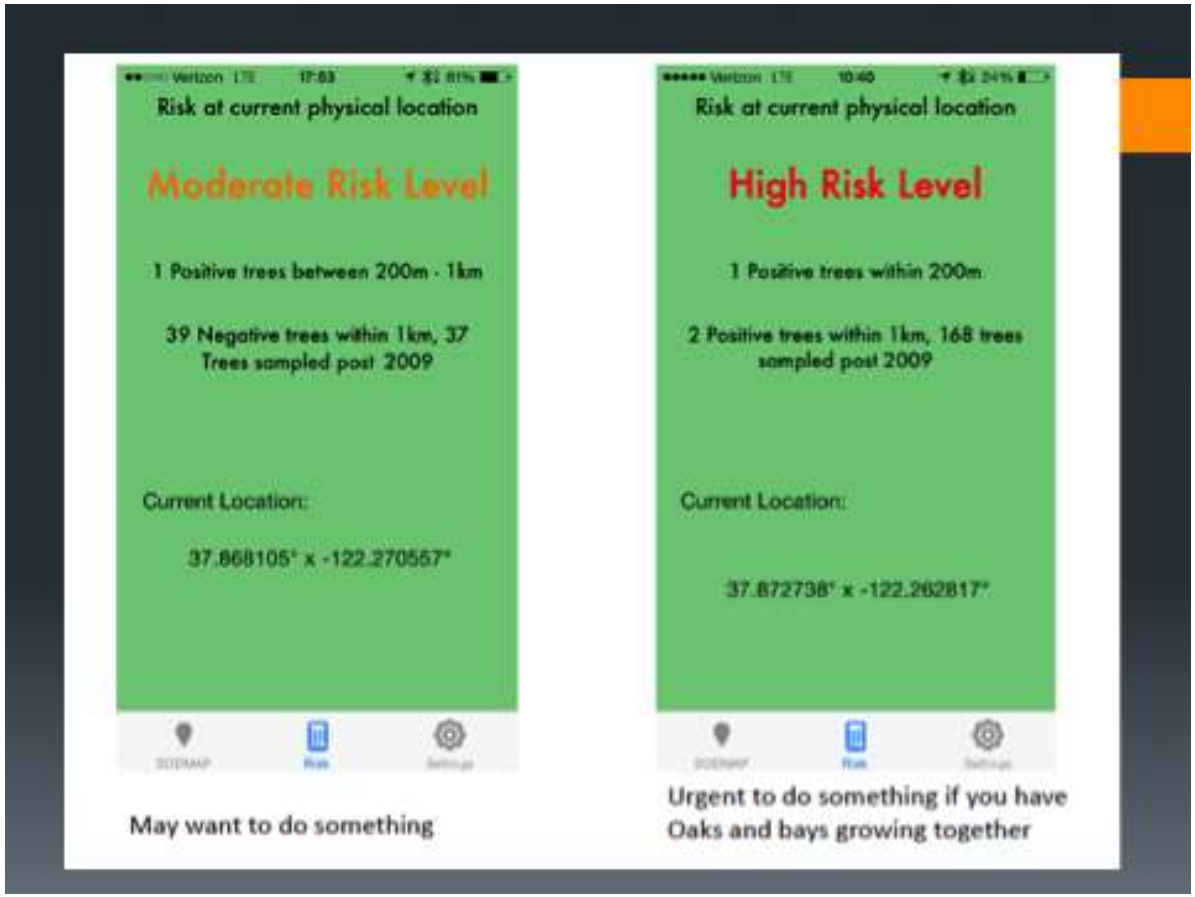
- Allows to look at the data by quadrant, resolving the issue of data overcrowding
- Allows to compare pathogen and host distributions
- Allows top calculate disease incidence by site, county, host and year

Matteolab.org

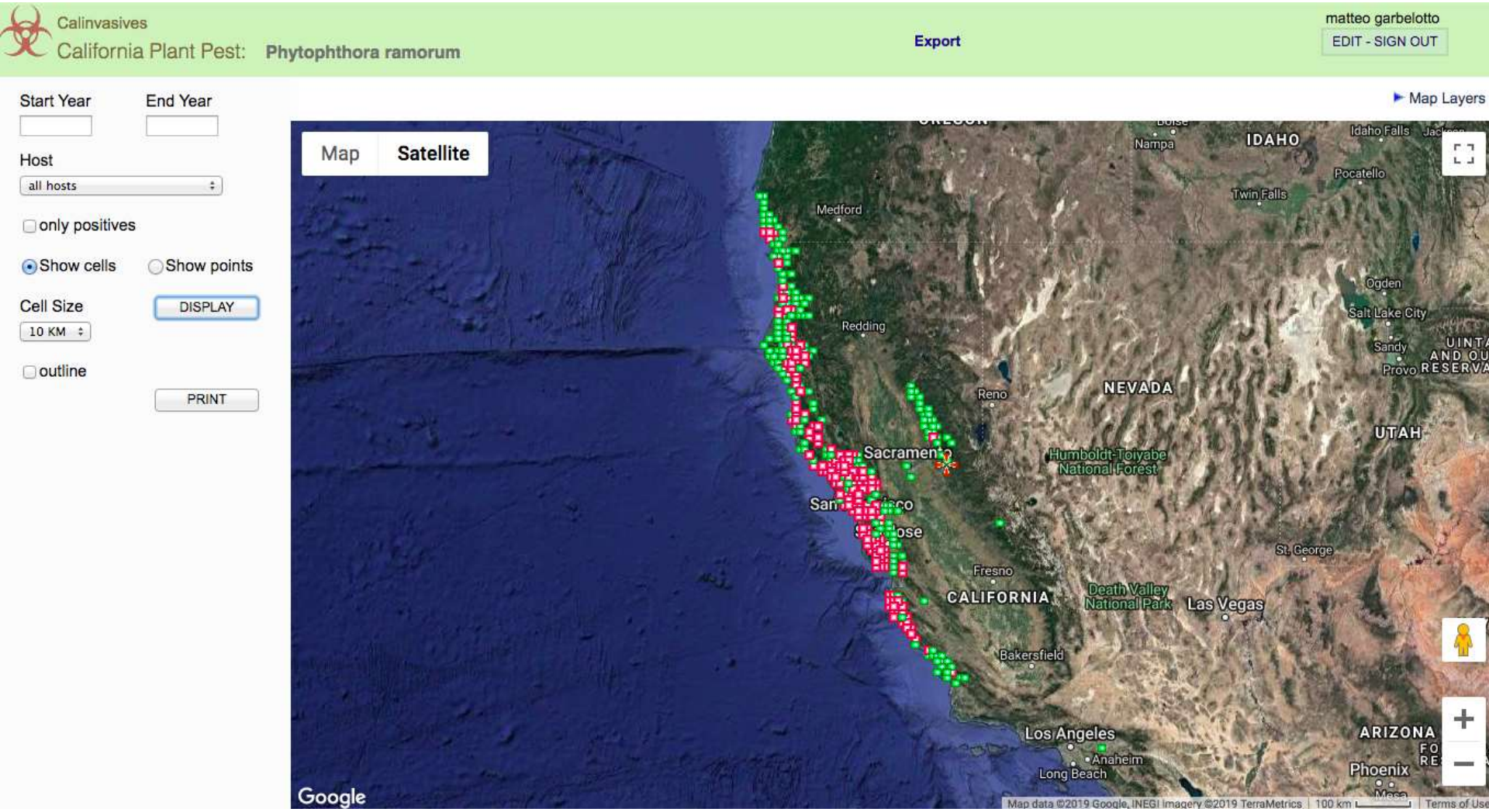
- All other websites contained in it
- New recommendations to manage SOD

Unique feature of SODmap mobile

- Risk of oak infection where user is standing



Calinvasives



Use 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

www.sodblitz.org
(TOP)

Google Map of Results

Results in Table format

www.sodblitz.org
(MIDDLE)

SOD Blitz Community Meetings and Workshops Schedule

Commentary on Results

Videos on what to do

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

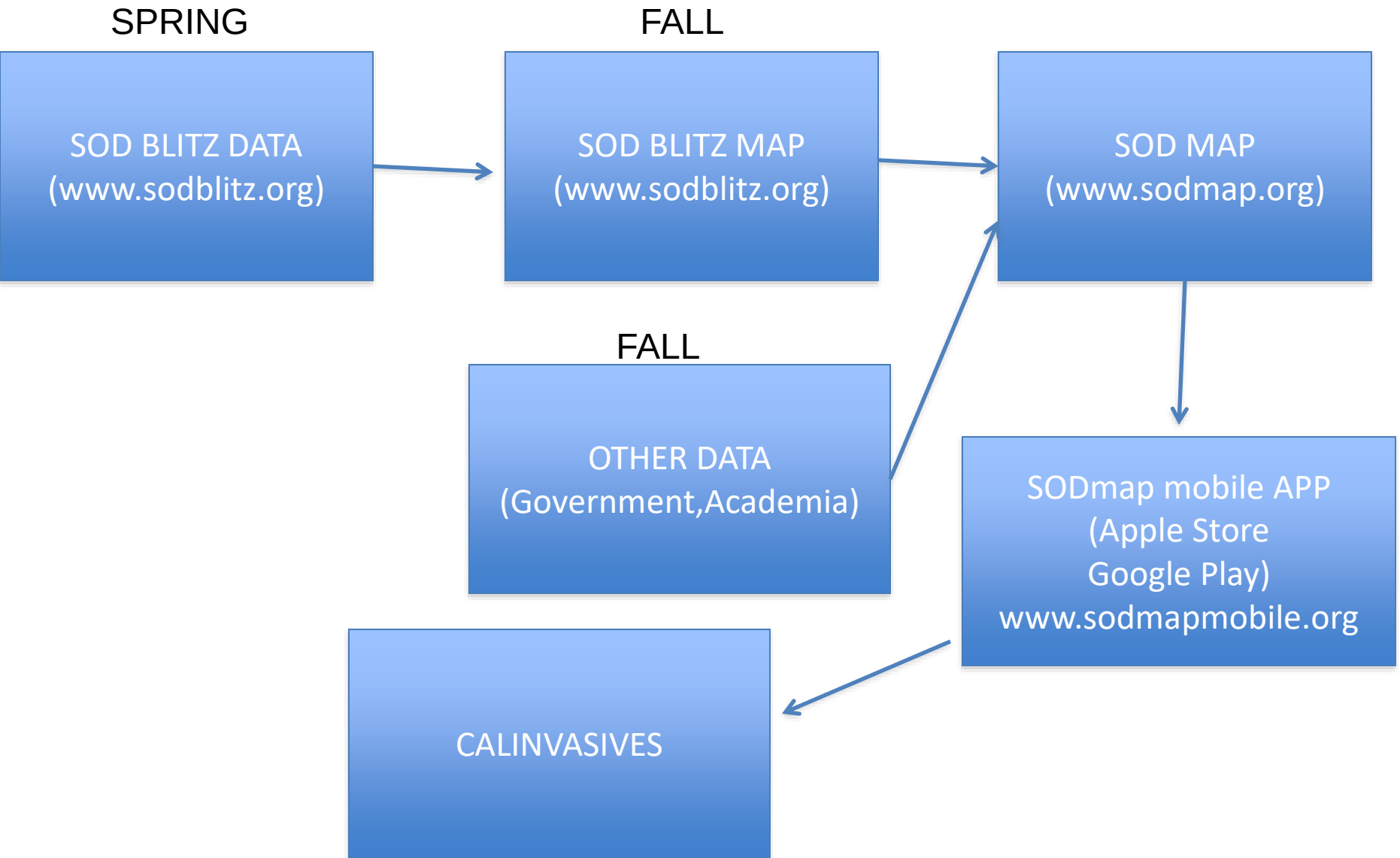
Link to 2012-2008 SOD Blitz Results

Previous years results

www.sodblitz.org
(BOTTOM)

Conversion file
To identify numerical code
For each tree

Data flow chart



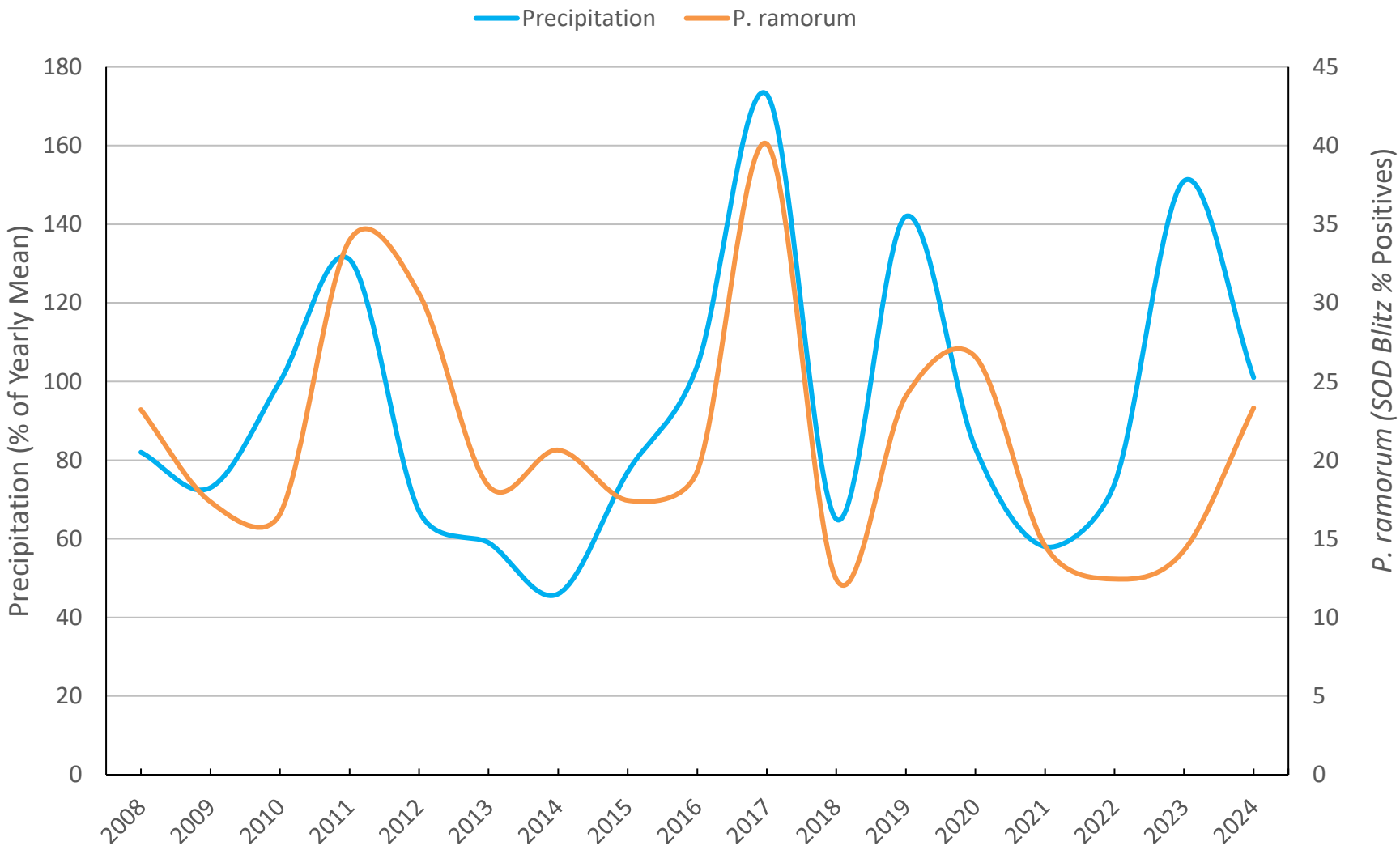
Both % positives and true
infection rates are double what they were last year and at
an overall intermediate level

A total of 300.000+ acres in 18 counties were surveyed

False negative rate= 2.7%
False positive rate=0%

Year	Surveyed Trees	Symptomatic Oaks Nearby? (%)	Sampled Trees	SOD Positive Sampled Trees %	Estimated True Infection Rate (%)	Symptomatic Surveyed Trees (%)
2024	23644	11.5	1848	17.2	5.7	32.9
2023	10291	11.8	1901	8.8	2.7	31.1
2022	10698	14.3	1805	7.1	2.9	43.8
2021	14804	10.6	2067	10.2	3.3	32.0
2020	21943	13.5	2030	21.5	7.4	34.3
2019	17287	12.4	1732	19.5	6.1	31.1
2018	13504	12.2	2012	9.8	3.5	35.7
2017	14379	9.4	2009	31.5	12.8	40.5
2016	14305	11.9	1878	16.1	5.7	35.7

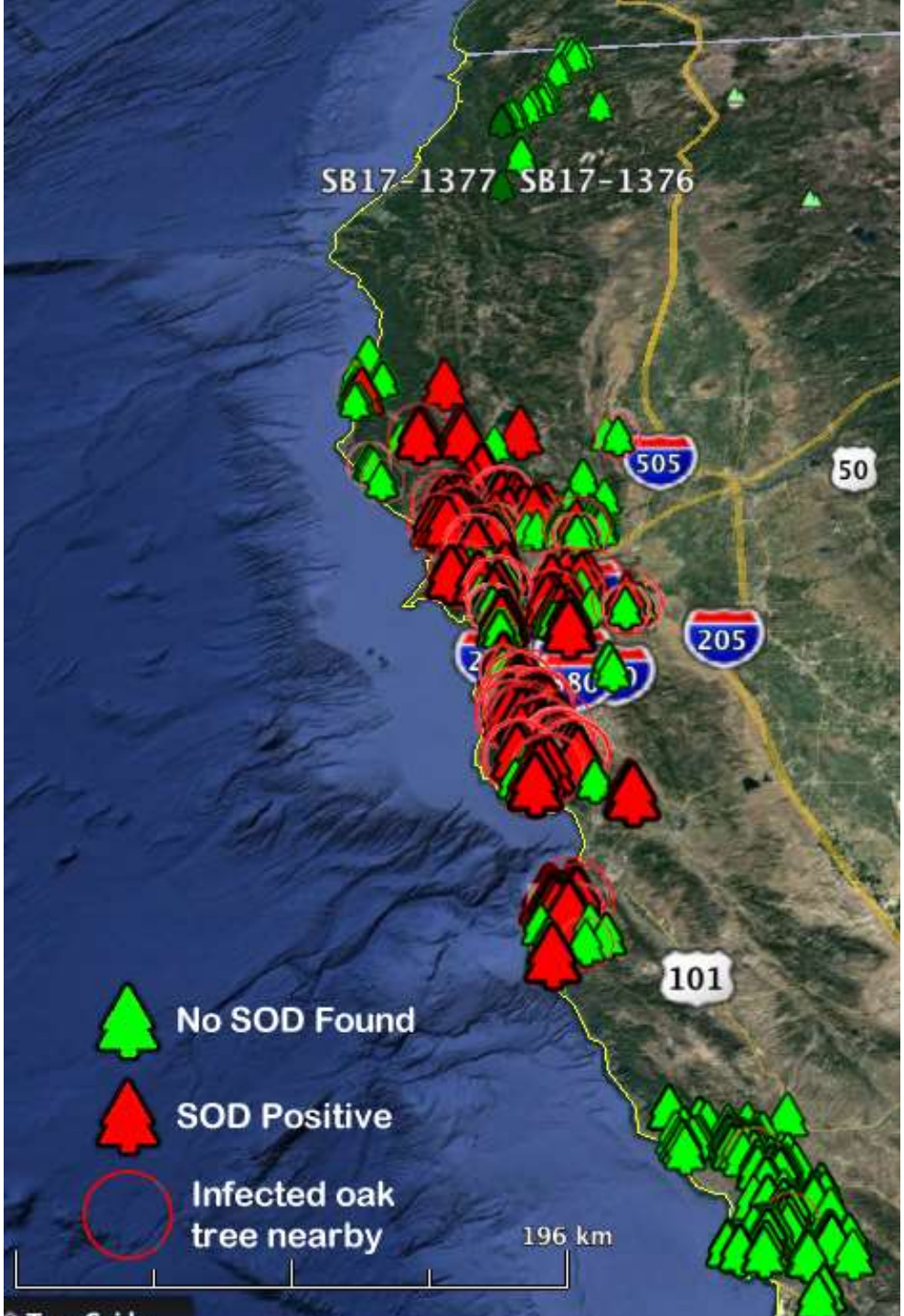
Precipitation and *P. ramorum*



Note: Blitzes with 0 Pr Positives removed.
NOAA data at Big Sur State Park WYTD

The SOD blitz regions

SOD Blitz Sampling Locations Central
Mendocino
Lake
Sonoma North
Napa
Sonoma West
Sonoma East
Marin
EB East
SF
EB West
EB South
Peninsula East
Peninsula West
Peninsula South
Santa Cruz



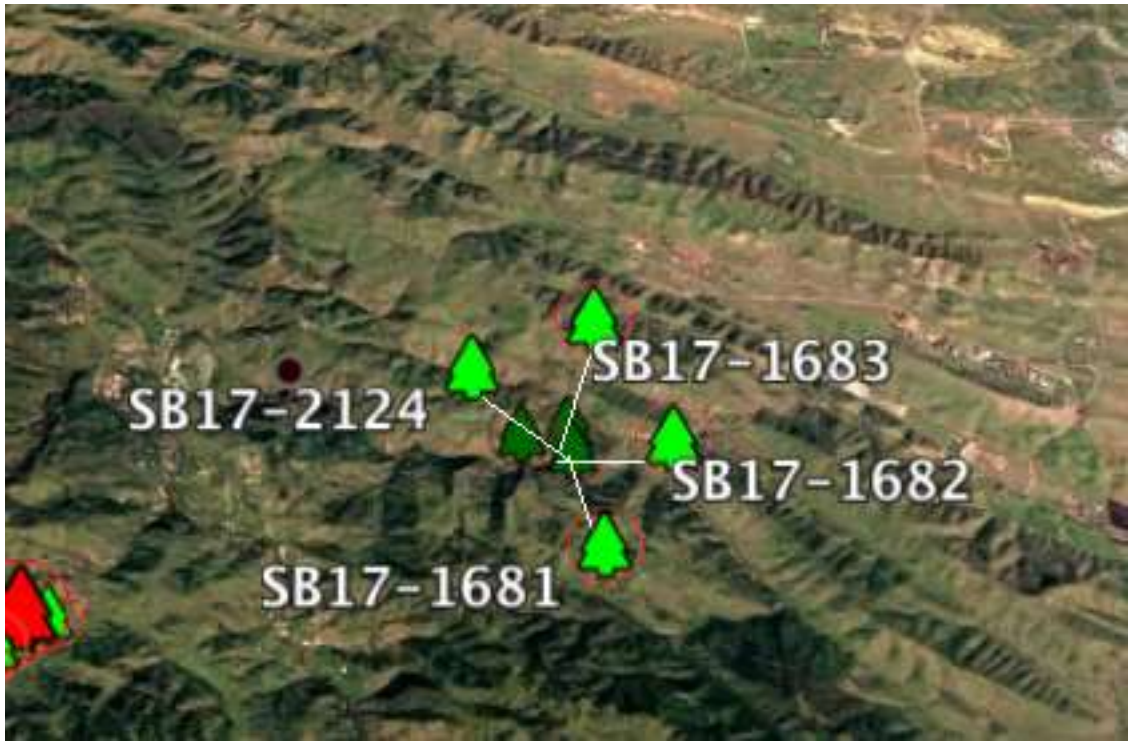
- Google Earth Platform
- All colored icons were tested
- Red= has SOD
- Green= had symptoms but not SOD
- Circle means oaks dying but for any reason (e.g drought)

Use these commands to:

move around map

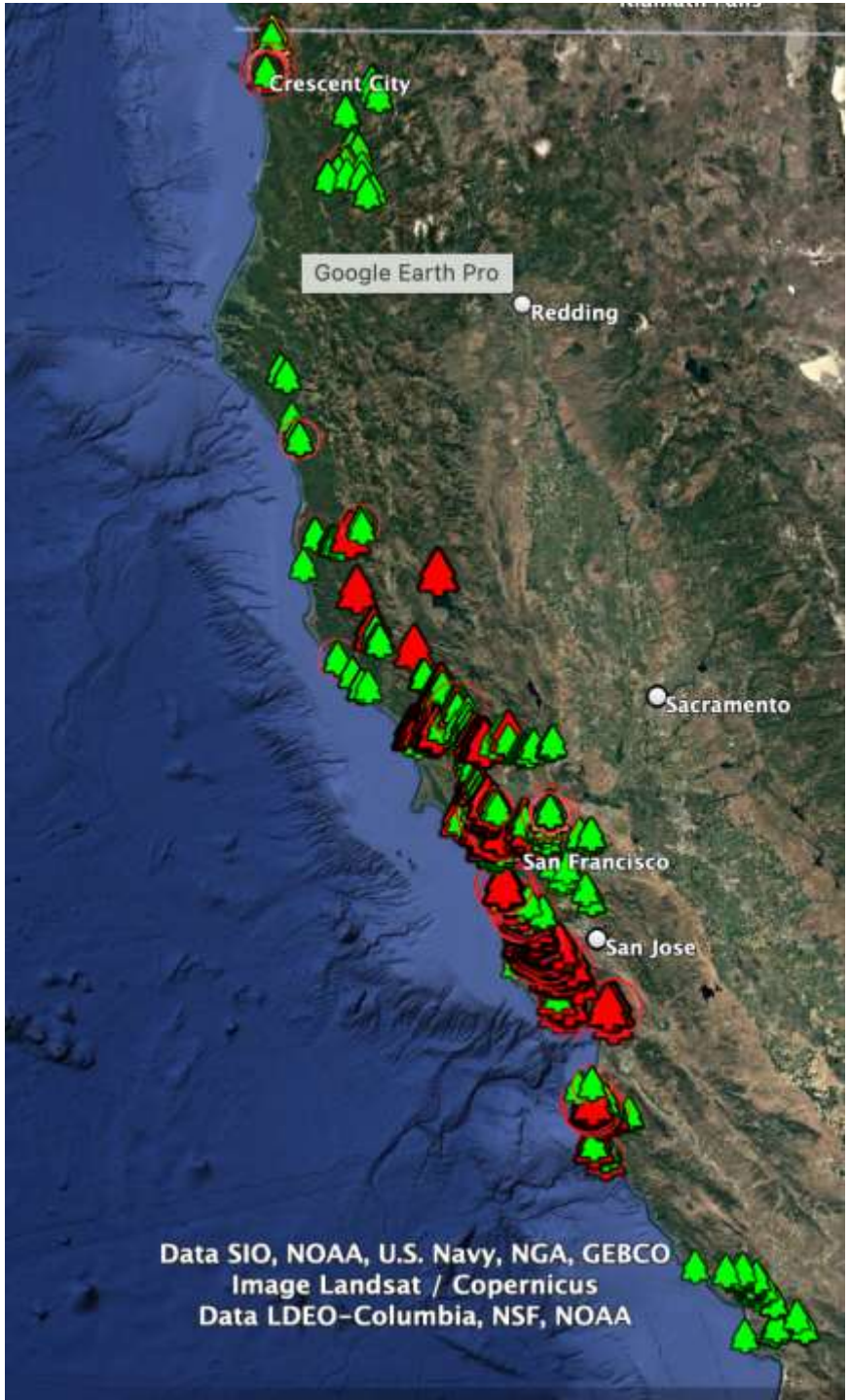
enlarge it

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



Comparison between 2024 and 2023

Location	Number of Surveyed Trees		Syptomatic Oaks Nearby? (%)		Number of Sampled Trees		SOD Positive Sampled Trees (%)		Estimated True Infection Rate (%)	
	2024	2023	2024	2023	2024	2023	2024	2023	2024	2023
Big Sur	148	68	8.6	6.3	25	16	12.0	68.8	3.5	65.7
Carmel	544	303	9.3	9.9	107	204	22.4	16.7	4.6	4.6
Del Norte	27	46	85.2	7.4	27	27	7.4	14.8		4.2
East Bay East	518	313	8.0	2.3	238	175	10.5	3.4	3.8	1.4
East Bay South	0	50	0.0	0.0	9	10	0.0	10.0		4.0
East Bay West	781	196	20.2	15.3	119	124	10.9	6.5	1.9	3.0
Humboldt	258	730	8.0	1.6	25	64	0.0	0.0	0.0	0.0
Lake	0		0.0		0		0.0			
Marin	561	355	11.8	18.9	144	111	36.8	18.9	31.9	4.0
Mendocino	481	266	11.1	3.0	63	67	6.3	1.5	0.6	0.3
Napa	86	192	0.0	11.7	43	77	2.3	0.0	1.1	0.0
Peninsula East	507	529	2.2	15.4	45	65	11.1	0.0	1.3	0.0
Peninsula North	85	104	13.5	33.3	52	3	32.7	0.0	13.1	0.0
Peninsula South	2056	83	2.4	25.0	42	32	35.7	9.4	18.4	4.1
Peninsula West	13706	2102	18.1	25.1	452	442	40.5	12.0	10.8	4.7
San Fancisco	841	834	0.0	0.9	111	106	0.0	0.0	0.0	0.0
San Luis Obispo	595	508	0.0	1.2	46	83	0.0	0.0	0.0	0.0
Santa Cruz	102	2035	24.1	20.0	54	5	35.2	0.0	16.6	0.0
Siskiyou	1484	230	0.0	14.8	36	27	0.0	0.0	0.0	0.0
Sonoma East	406	762	1.1	0.9	94	134	27.7	13.4	13.4	5.4
Sonoma North	39	44	10.5	6.7	19	15	5.3	6.7	2.0	2.8
Sonoma West	419	541	1.1	6.1	94	114	34.0	3.5	12.3	1.8
Trinity	0		0.0		3		0.0			
Total	23644	10291	11.5	11.8	1848	1901	15.0	8.8	4.9	2.7

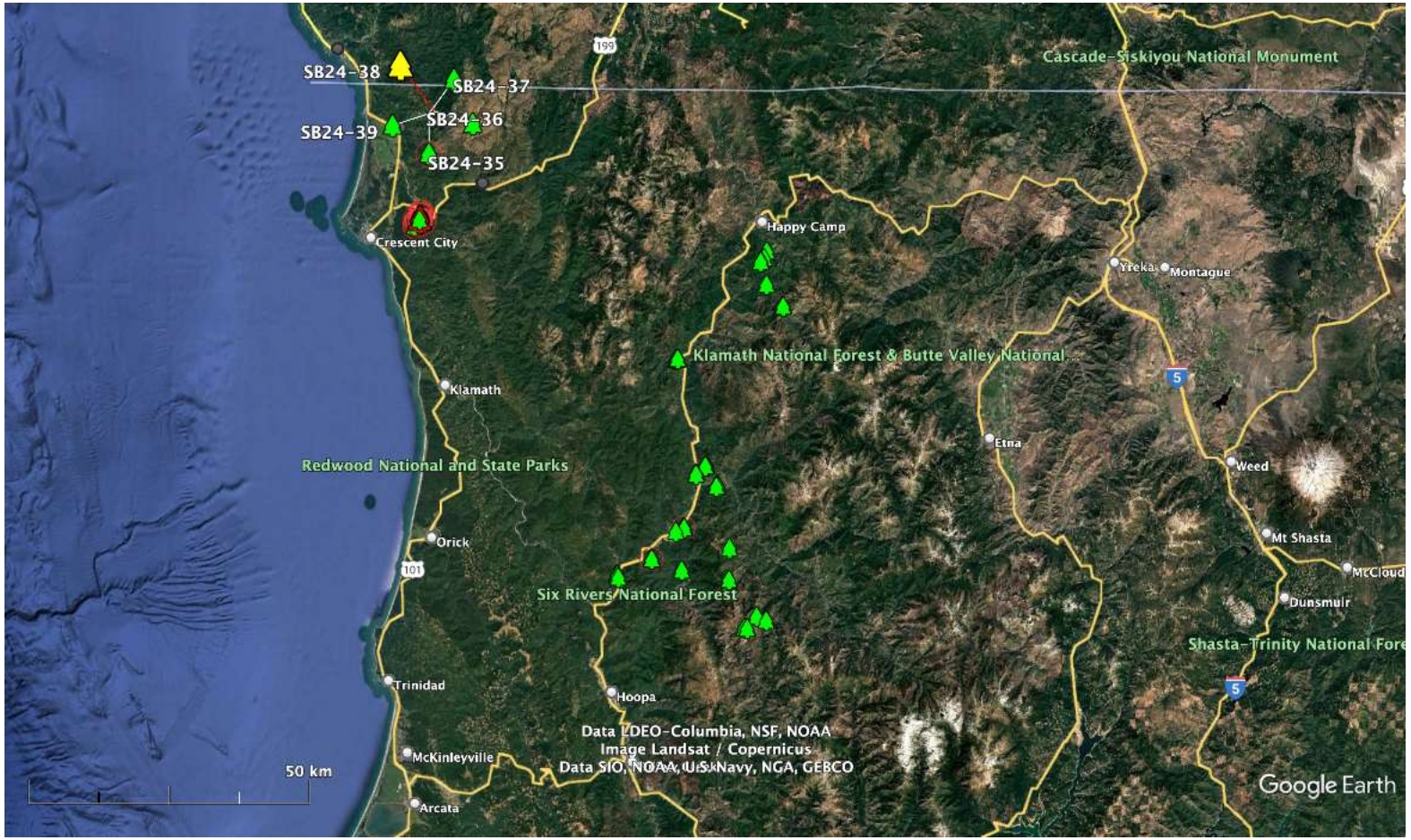


SOD Blitzes 2024

North Coast:

1- NA1 present but number of positives low, also NA1 unculturable

2- Tribal lands all negative

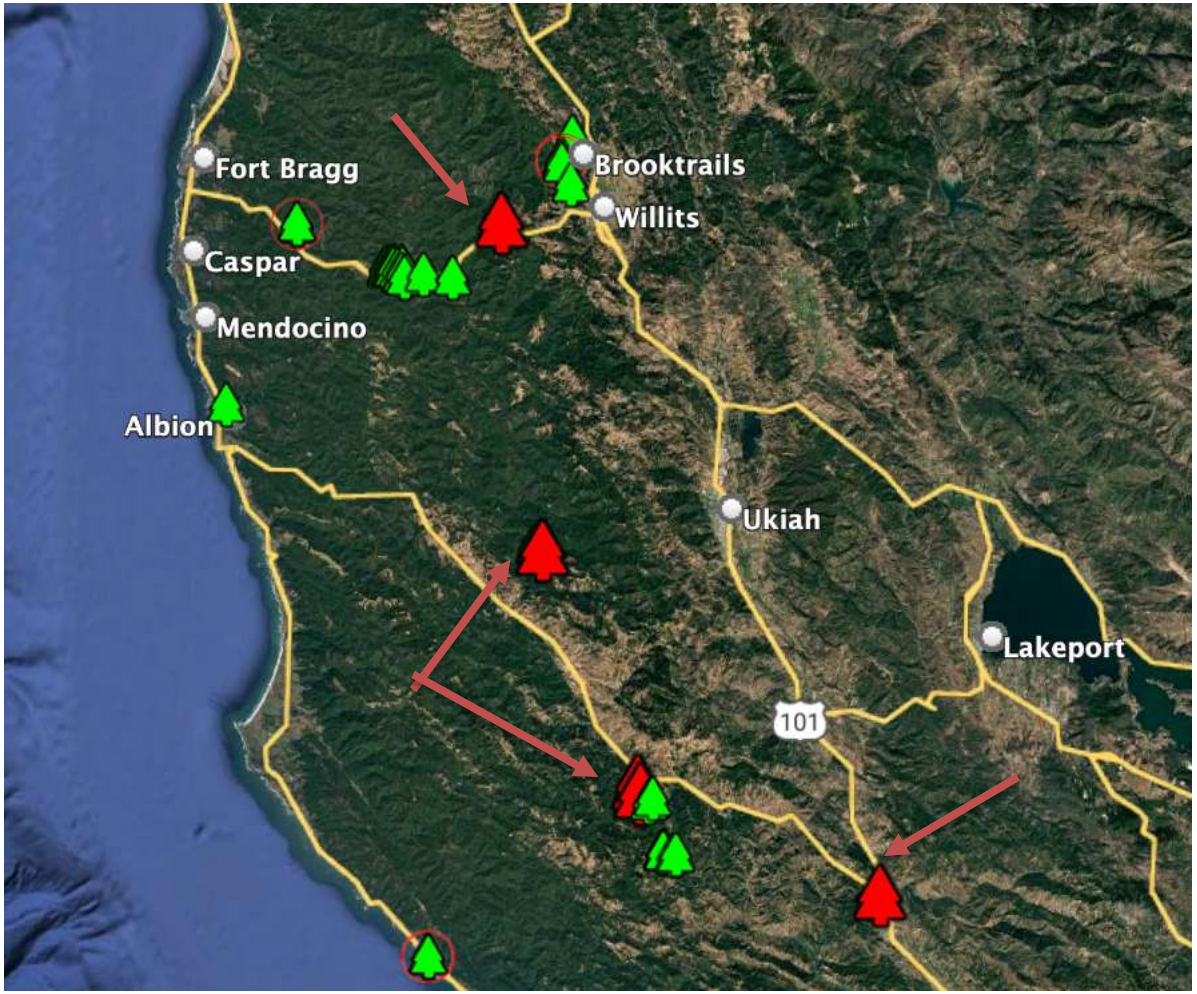


Mendocino-North Sonoma:

1- As usual Anderson Valley is positive

2- West of Willits positive; we have seen this before

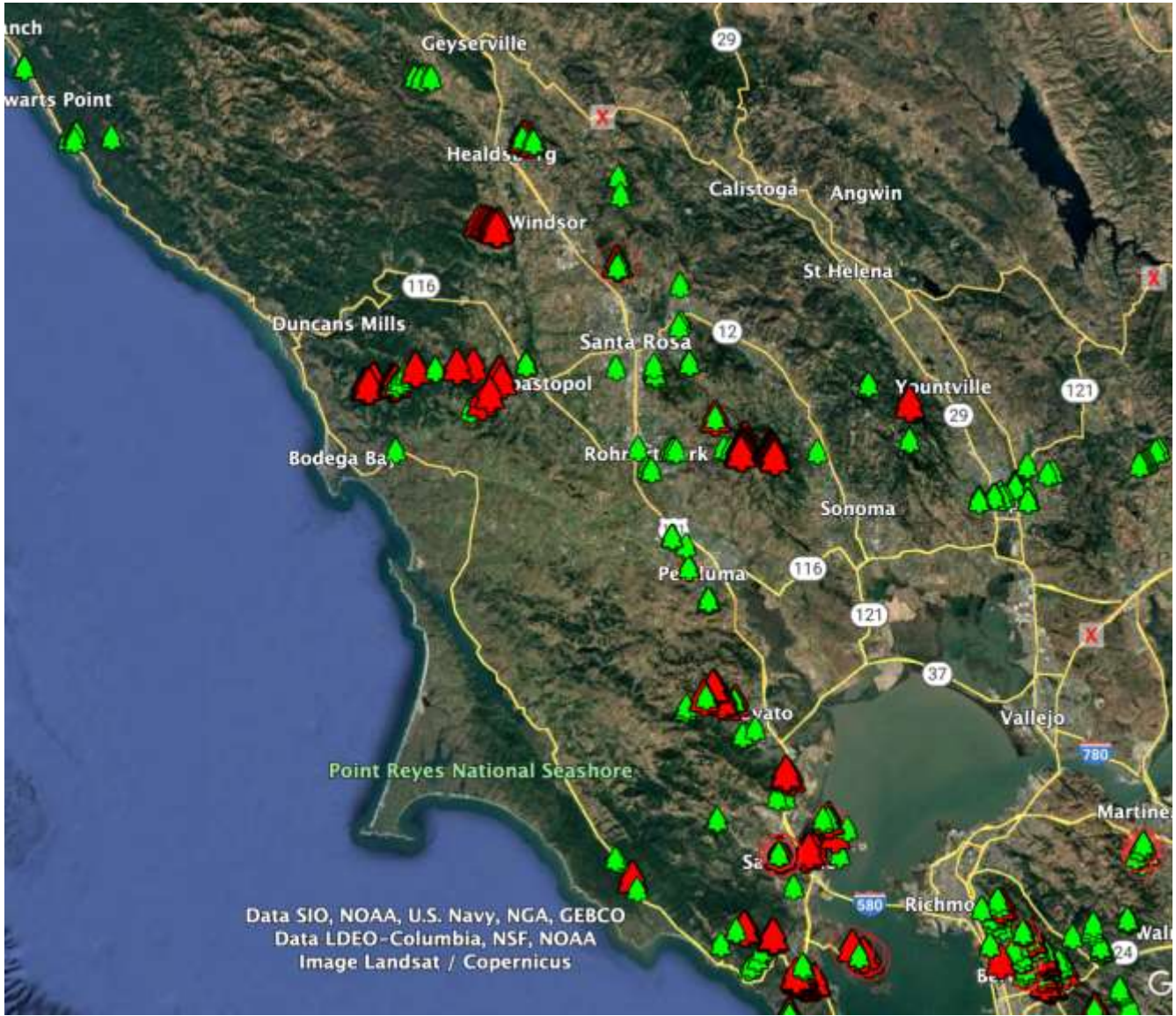
3- Cloverdale positive; Cloverdale is an excellent indicator



Sonoma, Napa, Marin

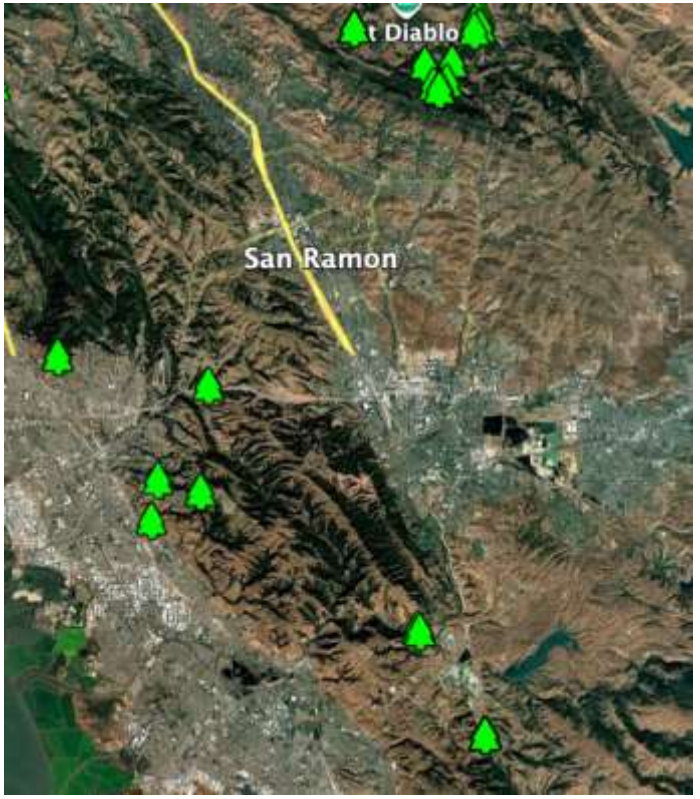
1- High disease incidence throughout Sonoma and Marin

2- Floor of Napa Valley remains negative



SF, SLO, South & East Bay Area

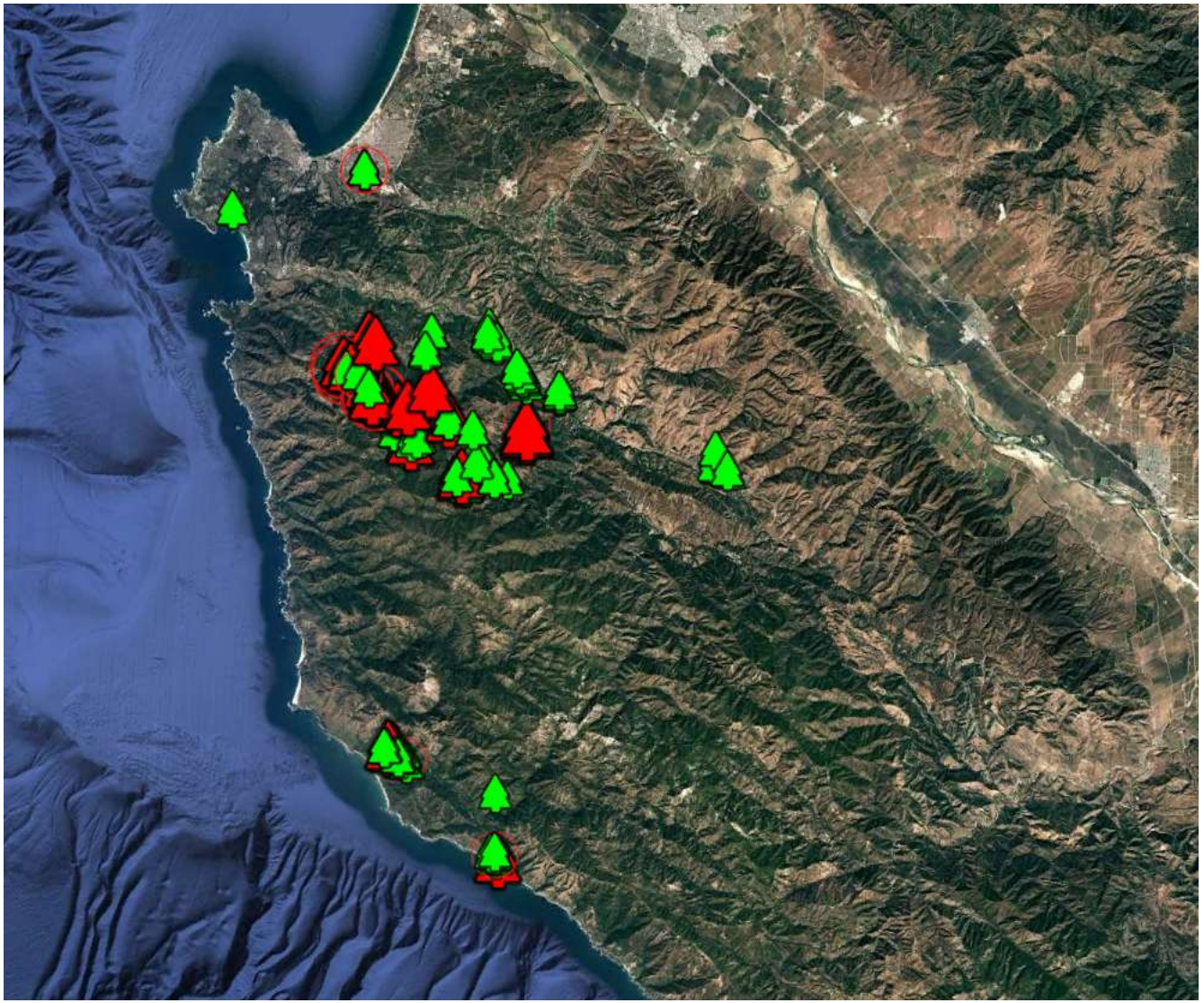
1- All negative



Three nurseries that participate and UCBG are negative, but trees around one nursery in the East Bay and UCBG are positive

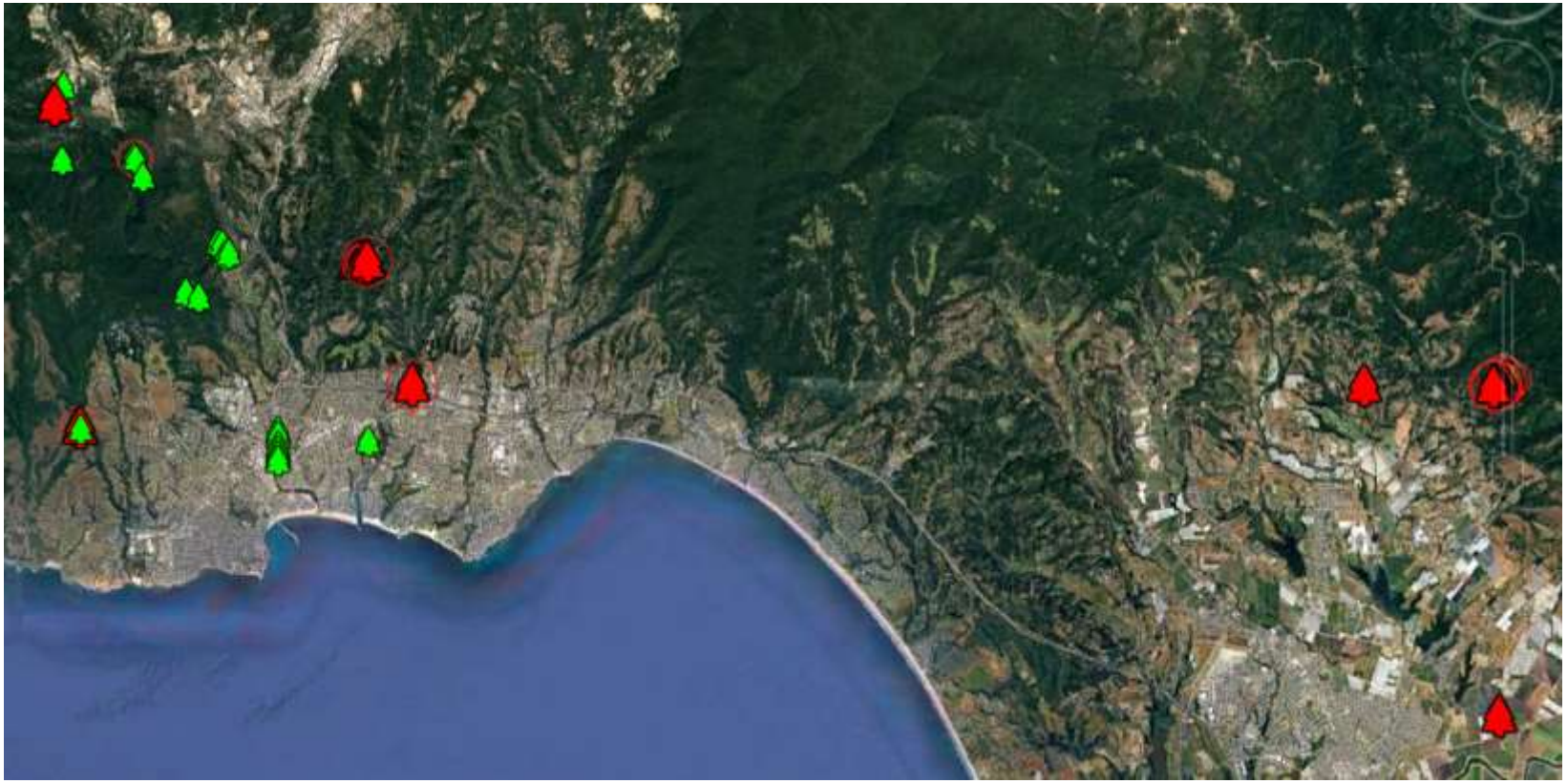
Carmel and Big Sur

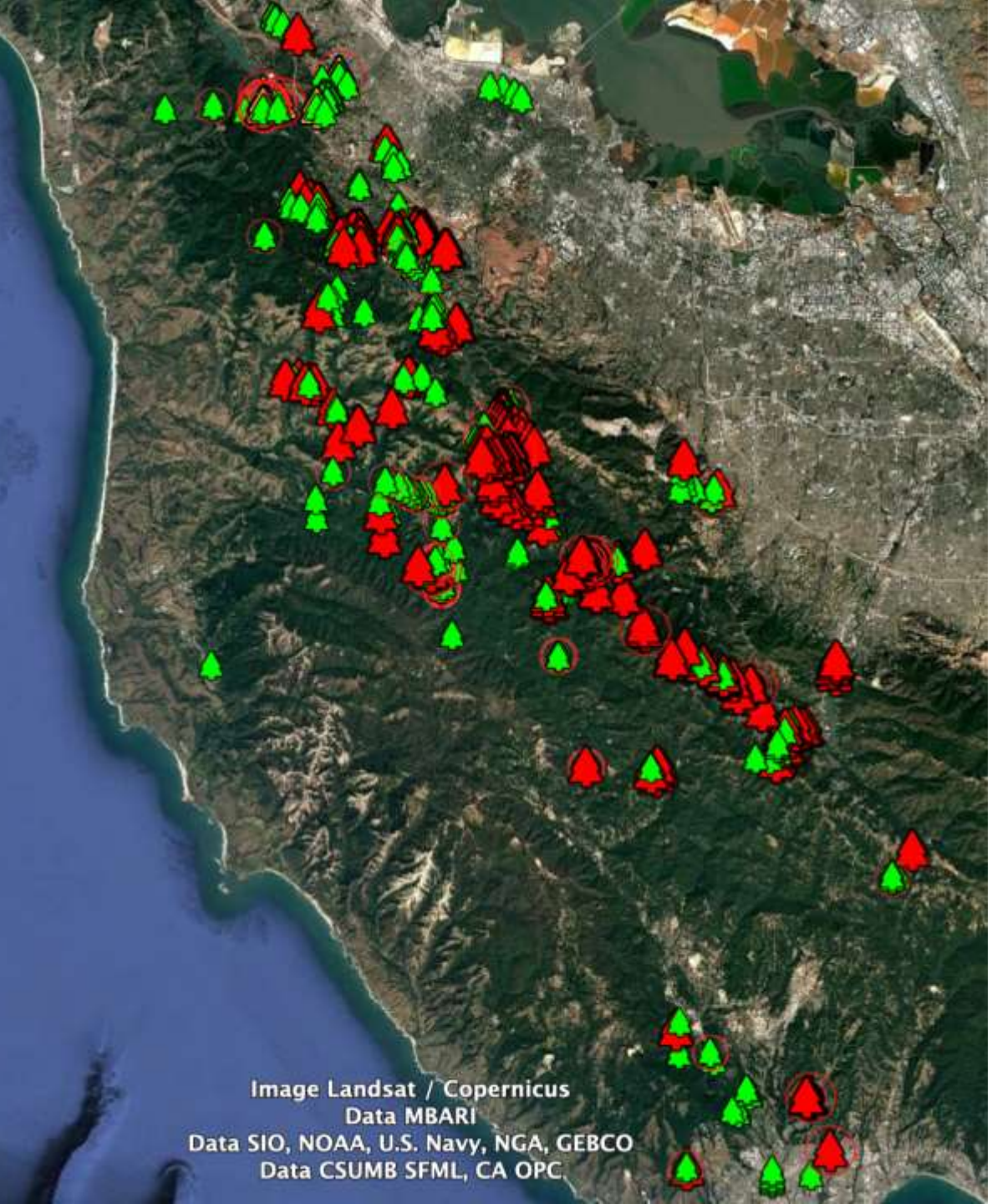
1- Status Quo, infections in canyons but not in the floor bottom of the Carmel Valley



Santa Cruz

1- Several positives in unexpected locations, in addition to outbreaks in the Mountains (not shown here)





Santa Cruz Mountains

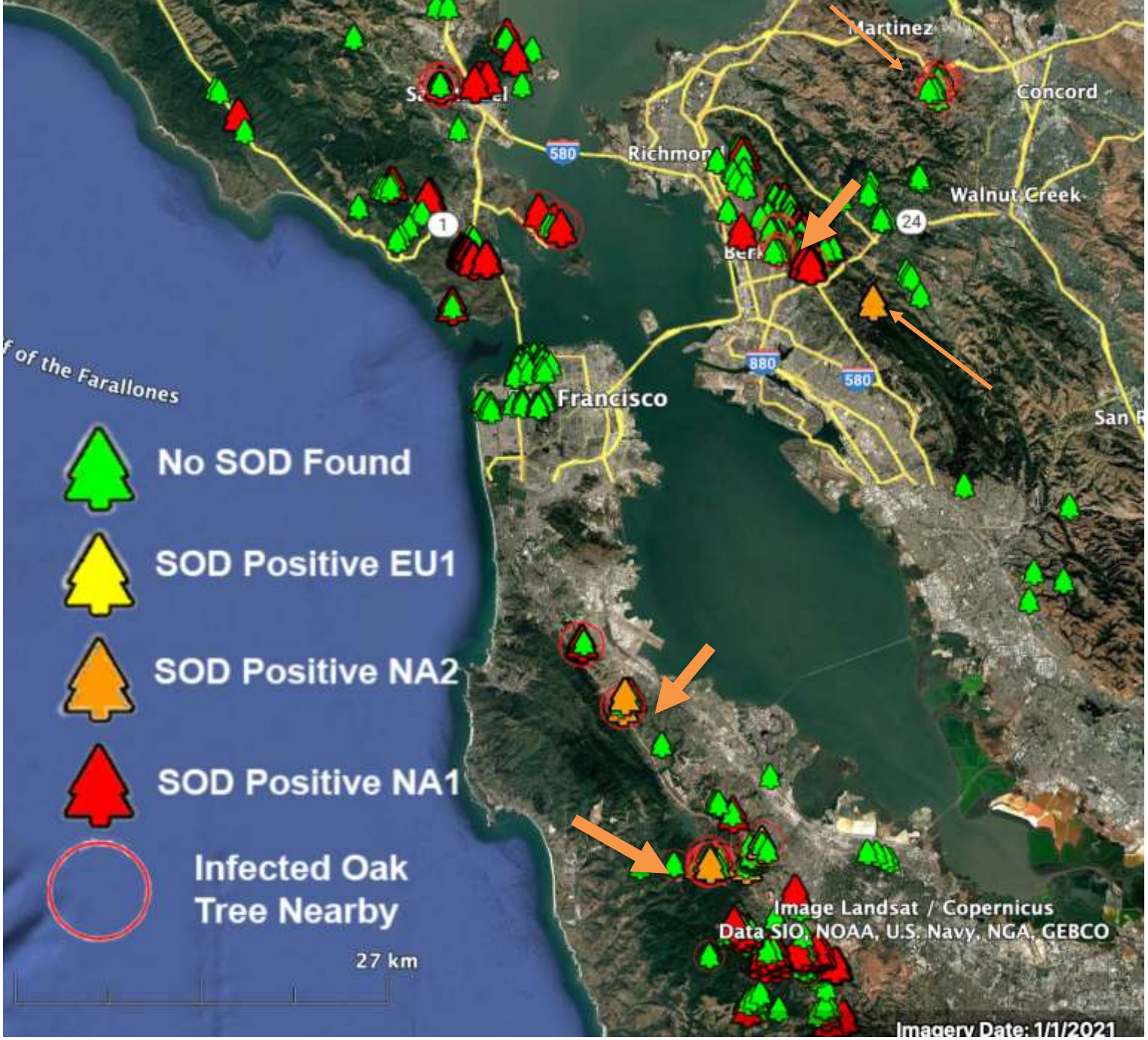
(San Mateo, Santa Cruz, Santa Clara)

1- Very large number of outbreaks, some reported for the first time

The Rise of NA2 in California

Five outbreaks detected

- Multiple samples collected by volunteers unexpectedly came out as NA2, based on sequencing of COX.
- We went back to the NA2 leaf samples in the freezers and reprocessed all of them from scratch: all were NA2 again. Control NA1 leaves were all NA1.
- We used the geospatial info given by volunteers to successfully locate all five outbreaks.
- **We resampled all five sites and increased sample size where possible (one site had one tree only).**
- **DNA confirmed four of five sites, culturing confirmed the three larger outbreaks.**



Mutiple trees

Single trees

Mid-Peninsula

1- Largest outbreak, reconfirmed by DNA and culturing

2- Eleven samples

3- Three Km wide

4- All positives were NA2! (suggests NA2 has a competitive advantage)

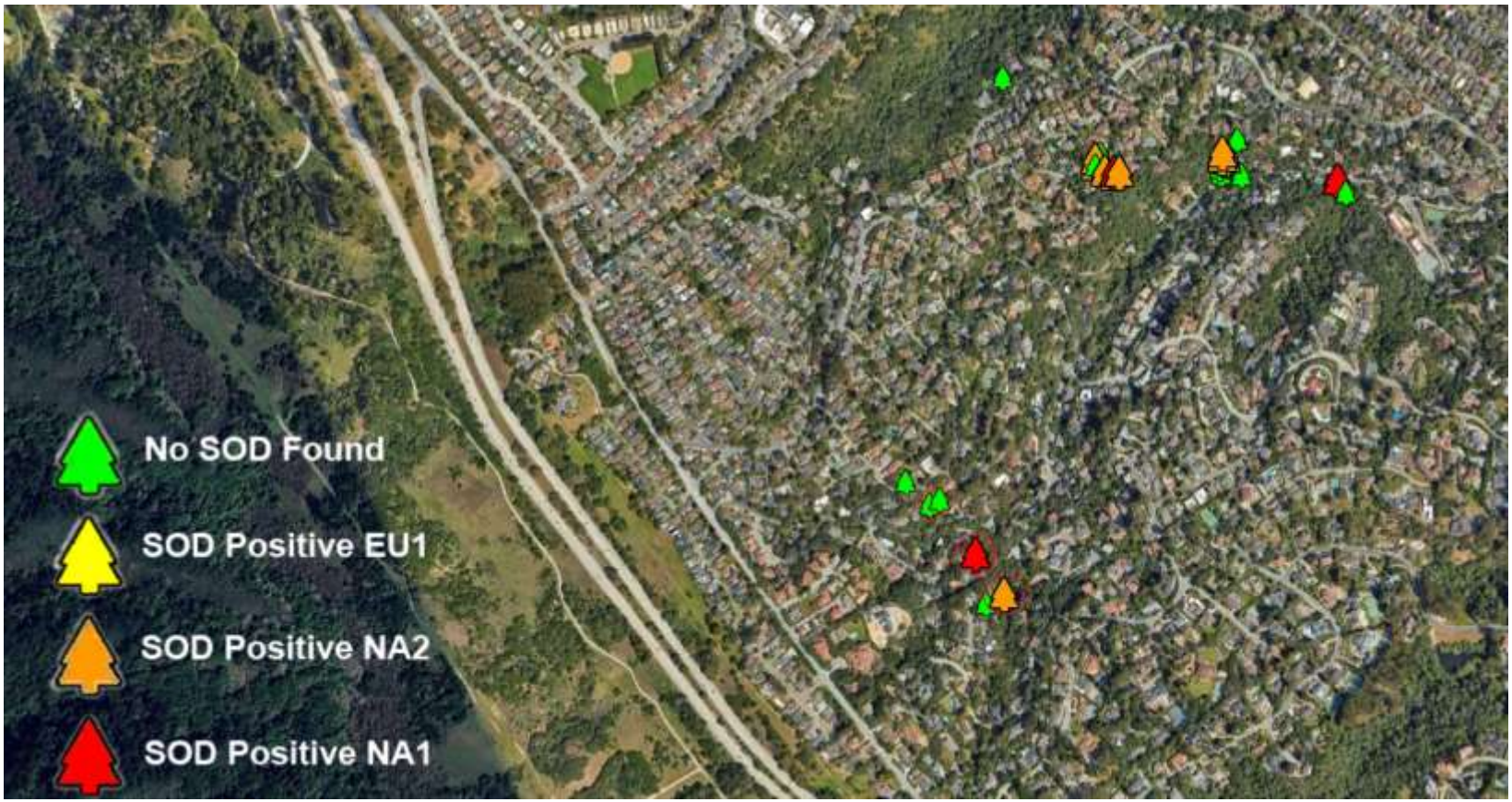
North-Peninsula

1- Second largest outbreak, reconfirmed by DNA and culturing

2- Eight samples

3- One Km wide

4- Mixed Na1 and NA2 (cooler site, younger infestation)



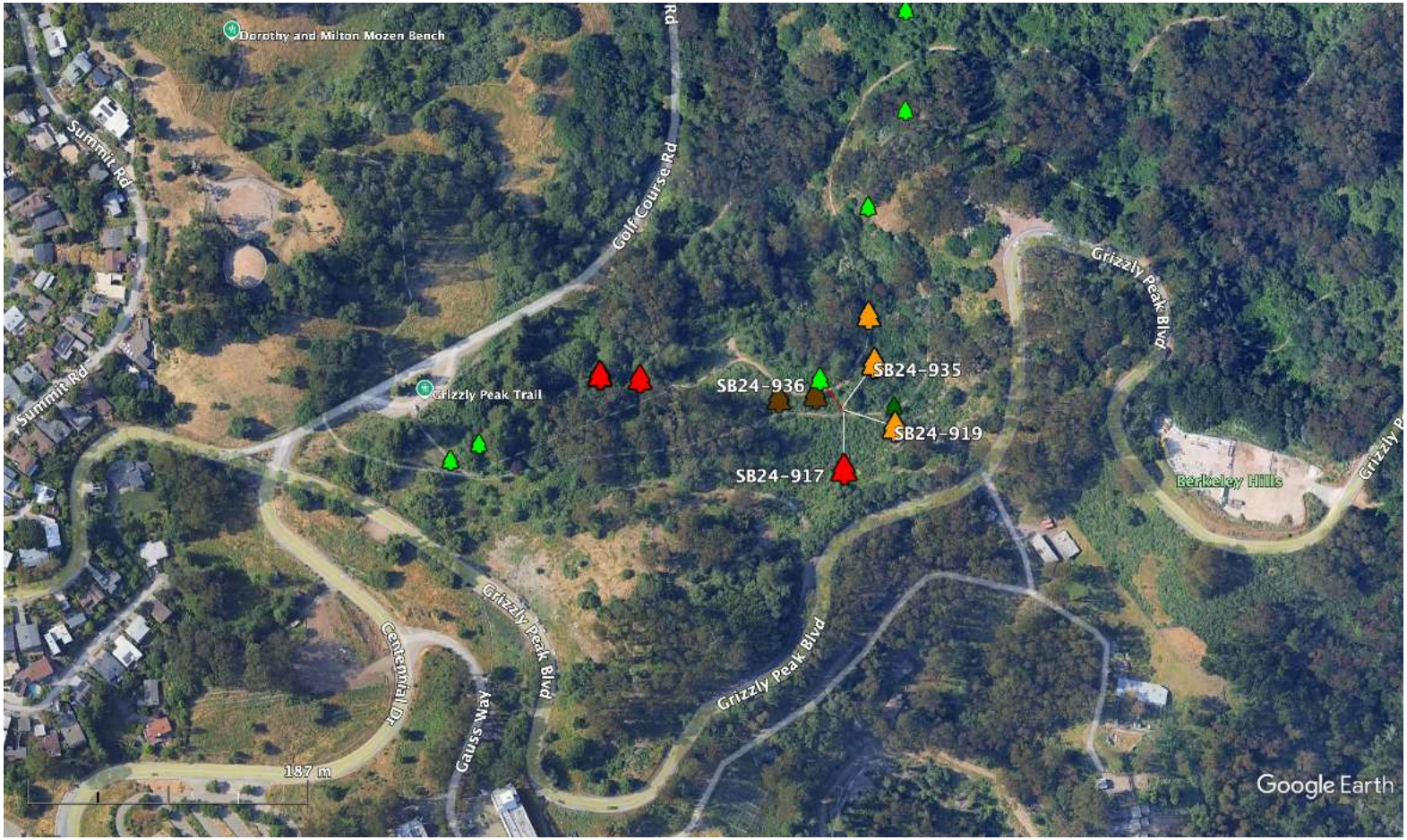
Tilden

1- Third largest outbreak, reconfirmed by DNA and culturing

2- Four samples

3- One hundred m wide

4- Mixed Na1 and NA2 (cooler site, younger infestation)



John Muir

1- Single tree, reconfirmed by DNA

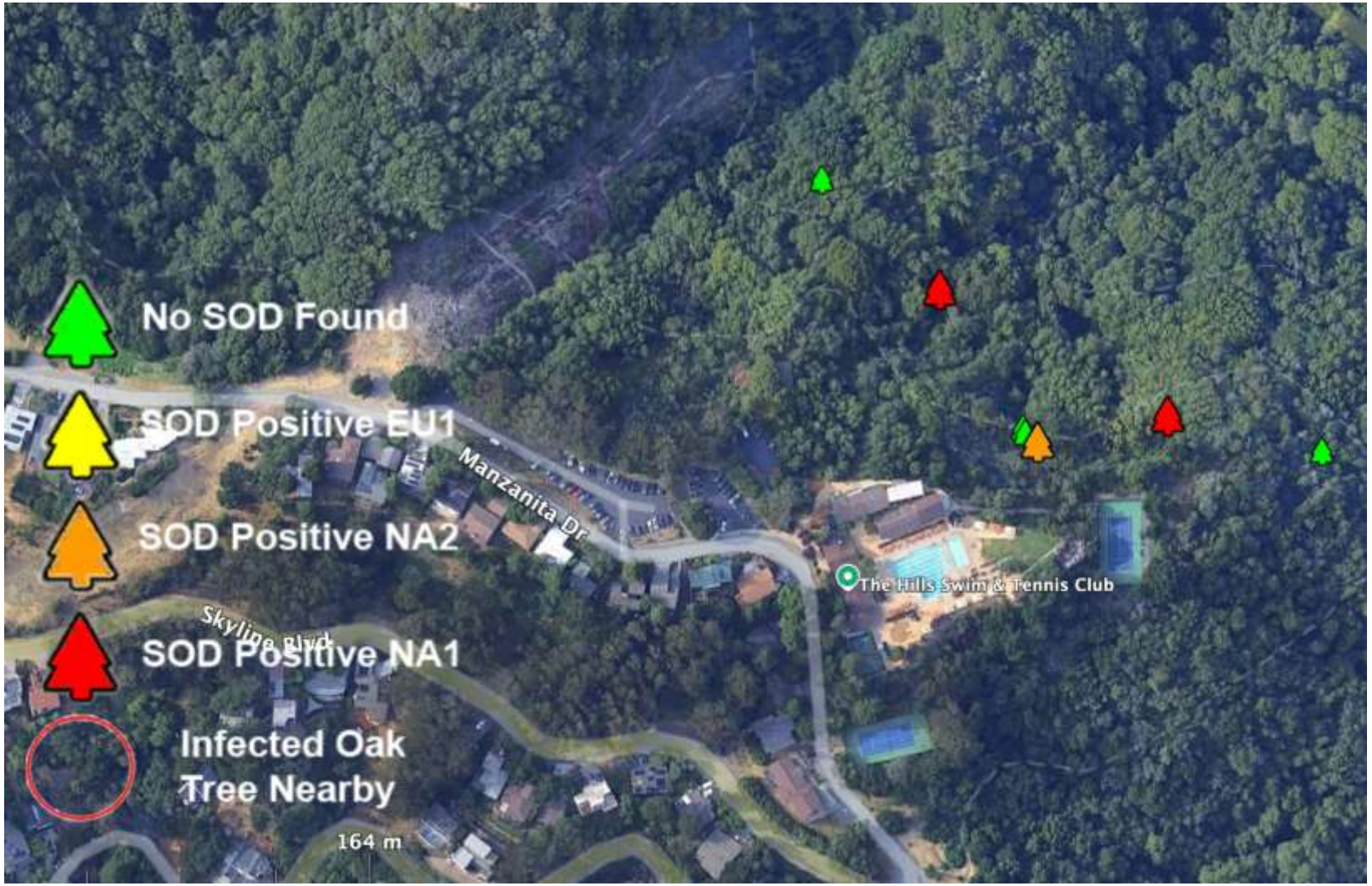
2- Again, no NA1s were identified this year

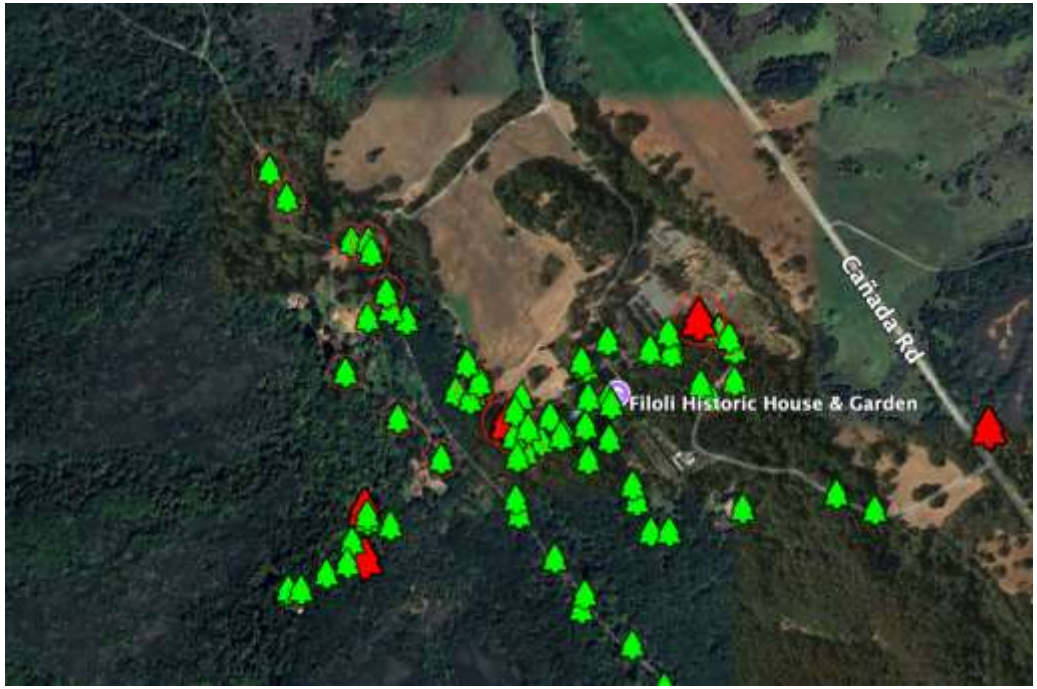
NA2 tree was positive in 2021

Eastport

1- Single tree, could not reconfirm but sample processed twice from scratch and both times came out positive

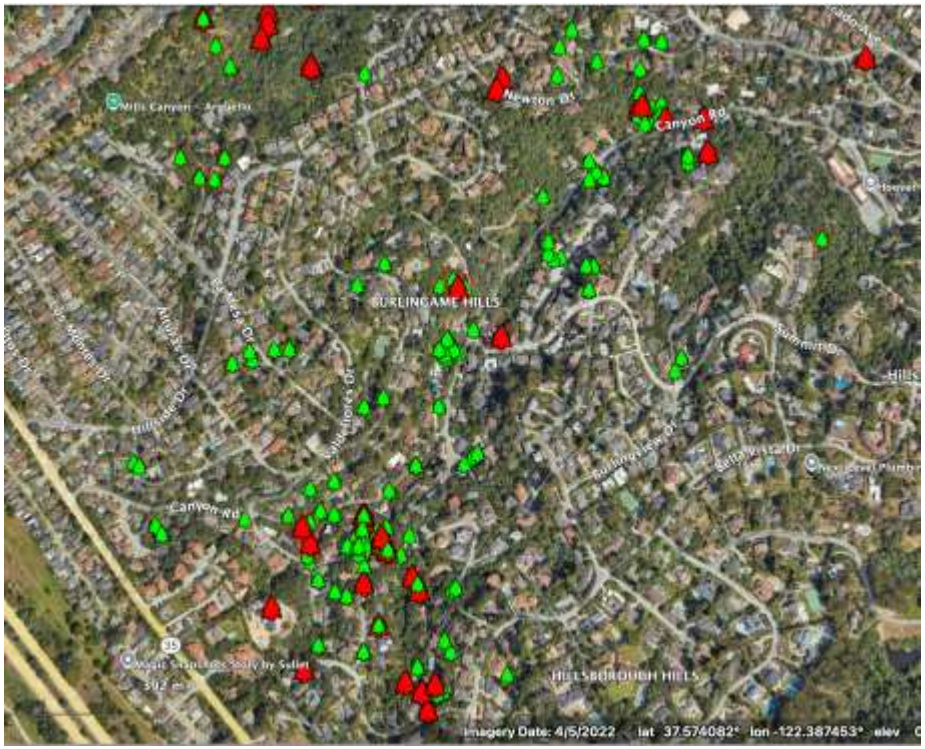
2- Both NA1s and NA2





2021

2021-2024



2008-2023

NA2 was present likely since 2015
Burlinghame Hills

2008-2024

Conclusions

- Statewide outbreak at intermediate severity
- Many new outbreaks in Santa Cruz County and in the Santa Cruz Mountains
- Nurseries and SF parks are Pram free and so is SLO!
- Interior outbreaks in Mendocino and Lake County (new outbreak reported here)
- NA2 are emerging at the same time: chance or climate-driven? We can show that in John Muir that the NA2 tree was positive in 2021 and in Burlingame Hills NA2 trees were positive in 2015
- NA2 reported as more aggressive and especially more infection in at least two papers (Hansen and Garbelotto groups). **Garbelotto et al show it is 4 times more infectious than NA1 in warmer temperatures**

Take Home message and future outlook

- Citizen Science is an invaluable tool to further our understanding of SOD and to provide critical information to stakeholders in real time
- Should we recommend NA2 bay removal as an optional approach?
- We are working with Richard Hamelin to genotype NA2s
- Maybe sequencing old collections from SOD Blitzes?

Oakstep.org

- Oakstep program was started because

- Confirmation of SOD on oak is important given that:

  - SOD infected oaks burn very hot
  - SOD infected oaks are likely to fail
  - Confirmation of SOD on one oak is the most pressing signal the landowner needs to protect other neighboring oaks

UC BERKELEY FOREST PATHOLOGY AND MYCOLOGY LAB

Home Donate New Treatment & Diagnosis Contact Publications TreeFAQs SM

OakSTeP Project

What is OakSTeP? **Oak S**OD **Te**sting **P**rogram is a new program aimed at making a step in the right direction towards the detection and control of Sudden Oak Death (SOD). The other major program aimed at empowering communities in the fight against SOD is called "SOD Blitzes" and allows lay people to identify and confirm the presence of SOD on California Bay Laurel and Tanoak leaves, the two major vectors for the disease in California forests. OakSTeP is a new program launched by the U.C. Berkeley Forest Pathology Laboratory aimed at filling the gap of knowledge on SOD in oaks. Currently, oak testing for SOD is prohibitively expensive and too complex to perform, even for tree care specialists. OakSTeP facilitates the cooperation between professional tree care specialists, oak owners who are their clients, and U.C. scientists to provide a rapid and inexpensive diagnostic service on SOD infection on oaks. Although "SOD blitzes" remain key in protecting oaks from SOD, by identifying the disease in its major vectors (Bay Laurels and Tanoaks) before oaks are infected, early detection of SOD on an oak in any given property, may allow a tree care specialist to save that oak, or more realistically, it may allow her or him to save uninfected oaks that grow nearby.

How Does OakSTeP Work?

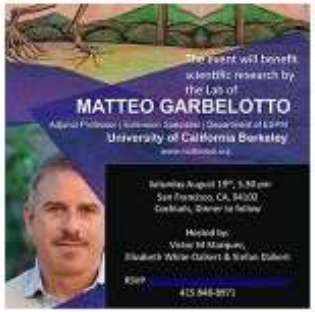
OakSTeP stands for "**Oak S**OD **Te**sting **P**rogram". It is a program directed at licensed tree care workers to provide them with all that is needed to sample symptomatic oaks at a fraction of the cost. By enrolling in the program, a licensed tree care worker will have access to the following:

1. Sets of Petri dishes and associated data forms directly delivered to them and to be used when sampling oaks.
2. Instructional Video and written instructions describing step by step all tools needed to sample oaks: when, where and how to sample oaks; where and how to send samples.
3. Analysis by the U.C. Berkeley state-of-the-art Diagnostic Lab.
4. Easy to read diagnostic reports that may be shared with clients.

Matteo's Instructional Video

OakSTeP

Special Event: An Evening to Support California Wild Lands and Native Forests



Secure Donation Page

CLICK HERE TO DONATE

Oakstep.org

-Program description

-Instructional video on how to sample oaks

-How to get all necessary materials

-Written instructions

-All forms needed to enroll and request materials

However: (II)

- Diagnosing SOD is the first step, but what about **treatments** to prevent disease spread? Only treatments will make a difference

- SOD treatment has a cost but is easy, all treatment to de done in the Fall: 1)- Identify high risk areas using SODmap mobile; 2)- Remove bay laurels 15 -30 feet around oaks you want to protect; 3)- Treat oaks that have very high value with phosphites

-Fill in the extended Treatment form record included in your collection packet. THIS WILL CREATE A DATABASE OF HOW MUCH CALIFORNIANS ARE WILLING TO INVEST TO STOP SODAND TO GET POLICY MAKERS TO INVEST MORE ON SOD

Fill in form inside packet or go to www.sodquest.org

Sudden Oak Death (SOD) TREATMENT SURVEY

Date: **Full Name:**

Zip code: **Email:**

Your position, circle one:

Owner Manager Renter Arborist or similar

Year when SOD was first officially diagnosed in property:

How was it diagnosed, circle all that applies:

SOD Blitz results

Ag commissioner/CDFA

Professional Arborist/private lab

Circle all tree species present in property:

Coast live oak	Shreve's oak	Black oak
Canyon live oak	Tanoak	California bay laurel

What actions have you taken to control SOD, circle all the apply:

Removed bay laurels around oaks

your contribution will remain anonymous

SODQUEST Survey 2024 Results

- 64 Responses
- 654 Trees were protected
- 148 Acres
- Average success rate 89% : Range 20-100%
- Average cost per tree $57

Sudden Oak Death

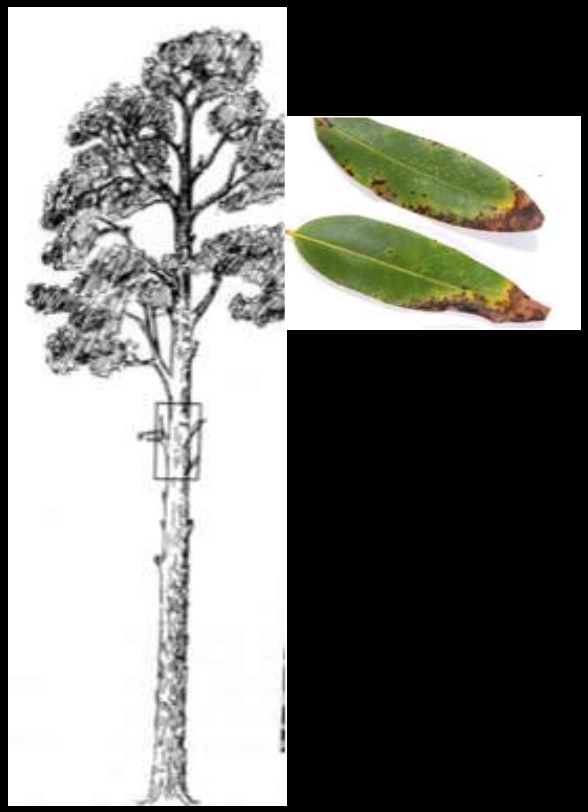
New disease caused by an exotic pathogen introduced in CA in the late 80s probably from Asia through infested ornamental plants. Oaks are completely susceptible (up to 100% mortality)

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

Risk for oak infection **only** when pathogen is within 200 yards

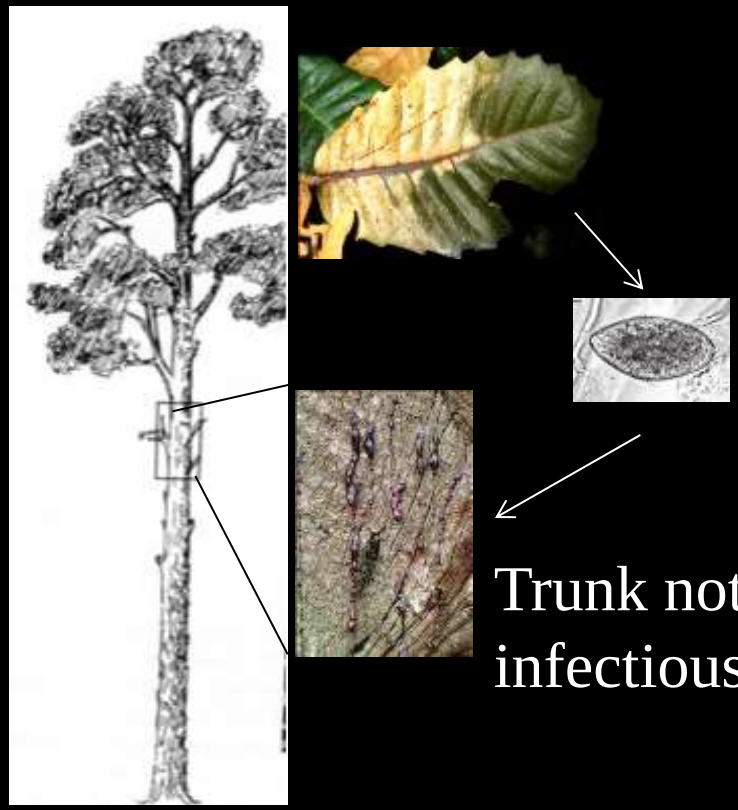
Infectious hosts in CA forests

- CA Bay Laurel



Only leaves,
highly infectious

- Tanoaks

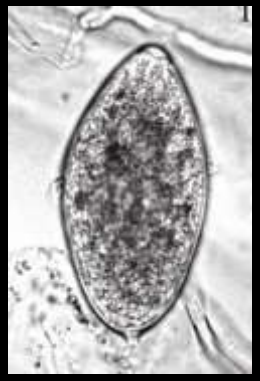


Leaves, petioles, twigs=infectious
(Branches, trunks=not infectious)

Bay/Oak association (not tanoak-oak)

Yearly, in spring, bay laurels

Coast Live Oak (no sporulation)



Wave years

Soil/Water

Five steps to control SOD

- Use the APP Sodmap mobile or the maps on SODblitz.org and SODmap.org to determine whether the location you are at is at risk of SOD infection (moderate or high) ARE YOU WITHIN A KM FROM KNOWN OUTBREAKS?

- In the Fall, remove bay laurels if their foliage is closer than 30 feet to oak stems or large branches. Need to treat stumps with herbicides

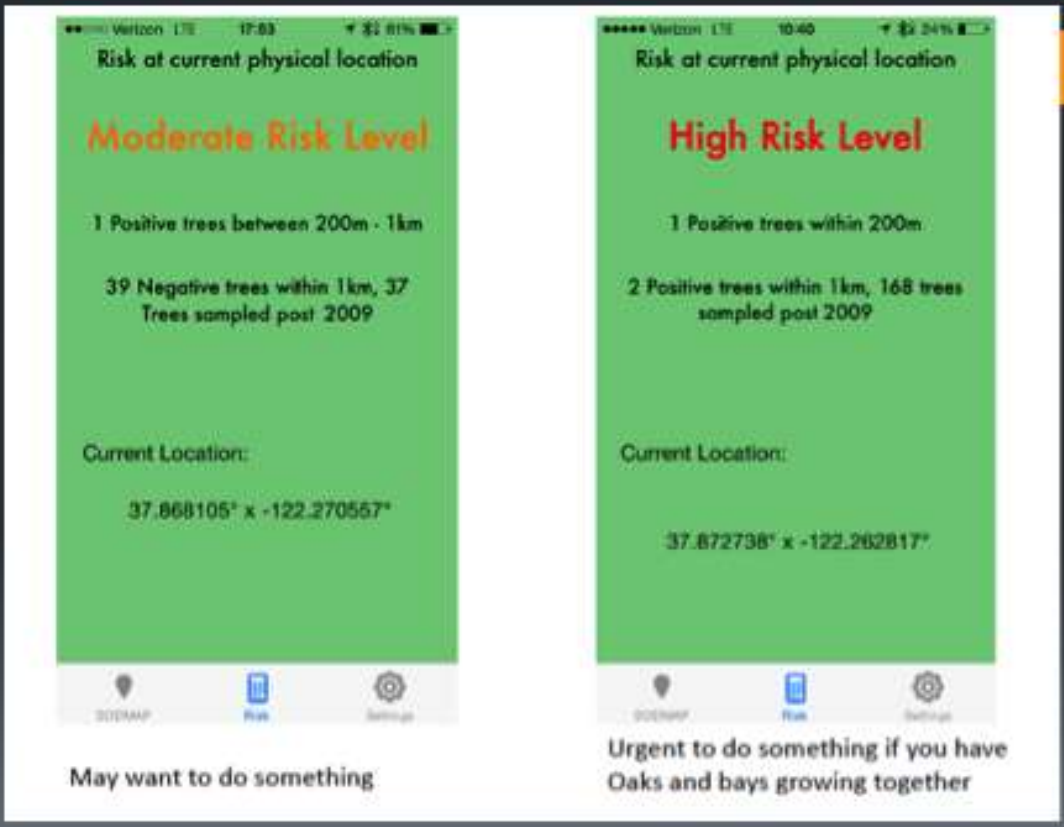
- For high value trees: Apply phosphonates as sprays with Pentrabark (trees under 25 inches diameter) or injections (trees with diameter > 25 inches) + broadcast anhydrous gypsum around the base of trunk (do not let the gypsum touch the trunk. Use 3-5 lbs per tree depending on tree size) .

- If bays regrow, they need to be recut. Phosphite treatment every two year, however if your neighborhood was well sampled two years in a row with no positive in both year you can skip a year

- Do major pruning and yard work in the late Summer early to mid Fall

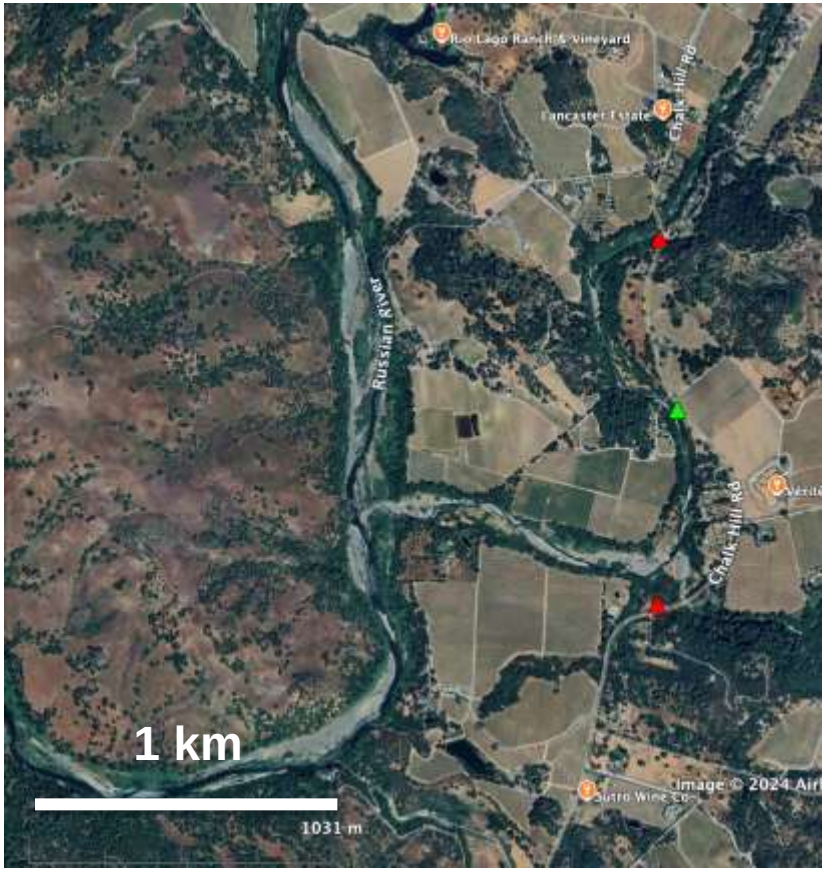
Unique feature of SODmap mobile

- Risk of oak infection where user is standing

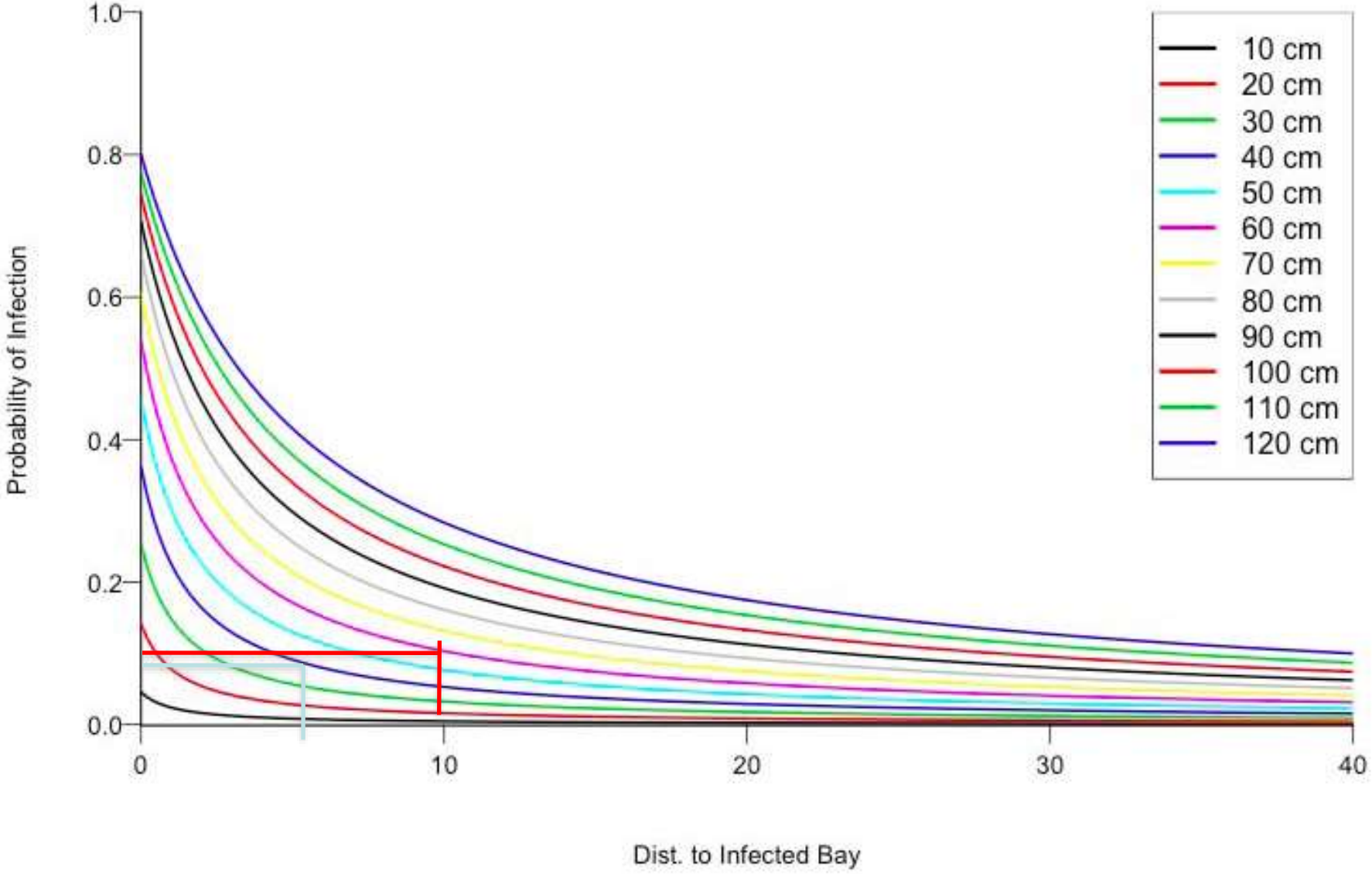


Use maps at

SODmap.org (all data until 2023 is default) **and** SODblitz.org (2024 data only default)



- Outbreaks within a Km & outbreak stage high or intermediate (based on SODblitz results), then do something


1.0
0.8
0.6
0.4
0.2
0.0
Probability of Infection
0
10
20
30
40
Dist. to Infected Bay
10 cm
20 cm
30 cm
40 cm
50 cm
60 cm
70 cm
80 cm
90 cm
100 cm
110 cm
120 cm

Drip-line to trunk distance (DTD)

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

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

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BARK PENETRATING SURFACTANT
PENTRA-BARK
CAUTION
Quest

Topical Treatment

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

1.5% final concentration of a.i., but inject twice as much, i.e. 20 mL

Injected Phosphonate Efficacy

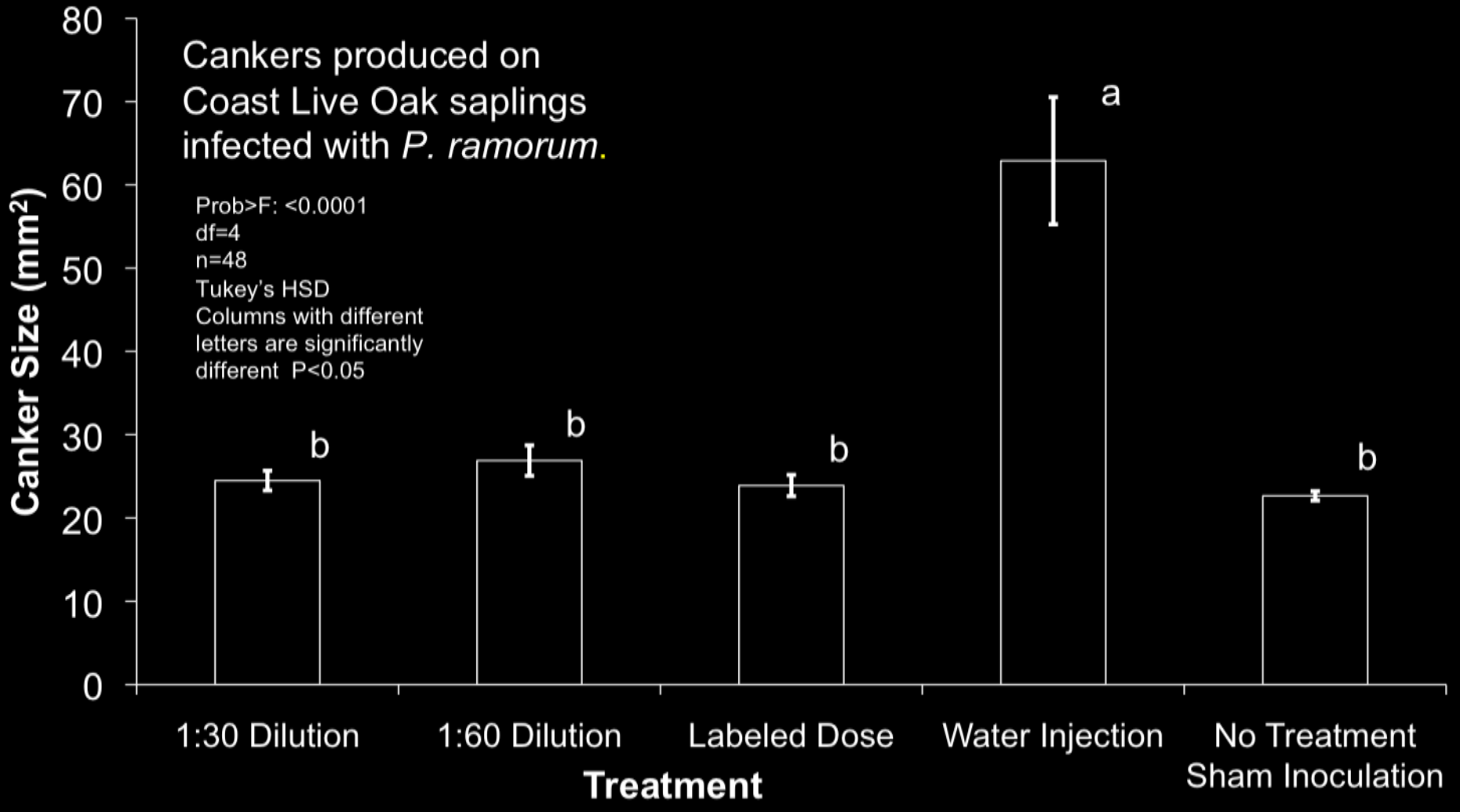


Figure 1. Efficacy of labeled dose vs updated dilution ratios. Smaller lesions = higher efficac

Phosphonate Damage to Wood

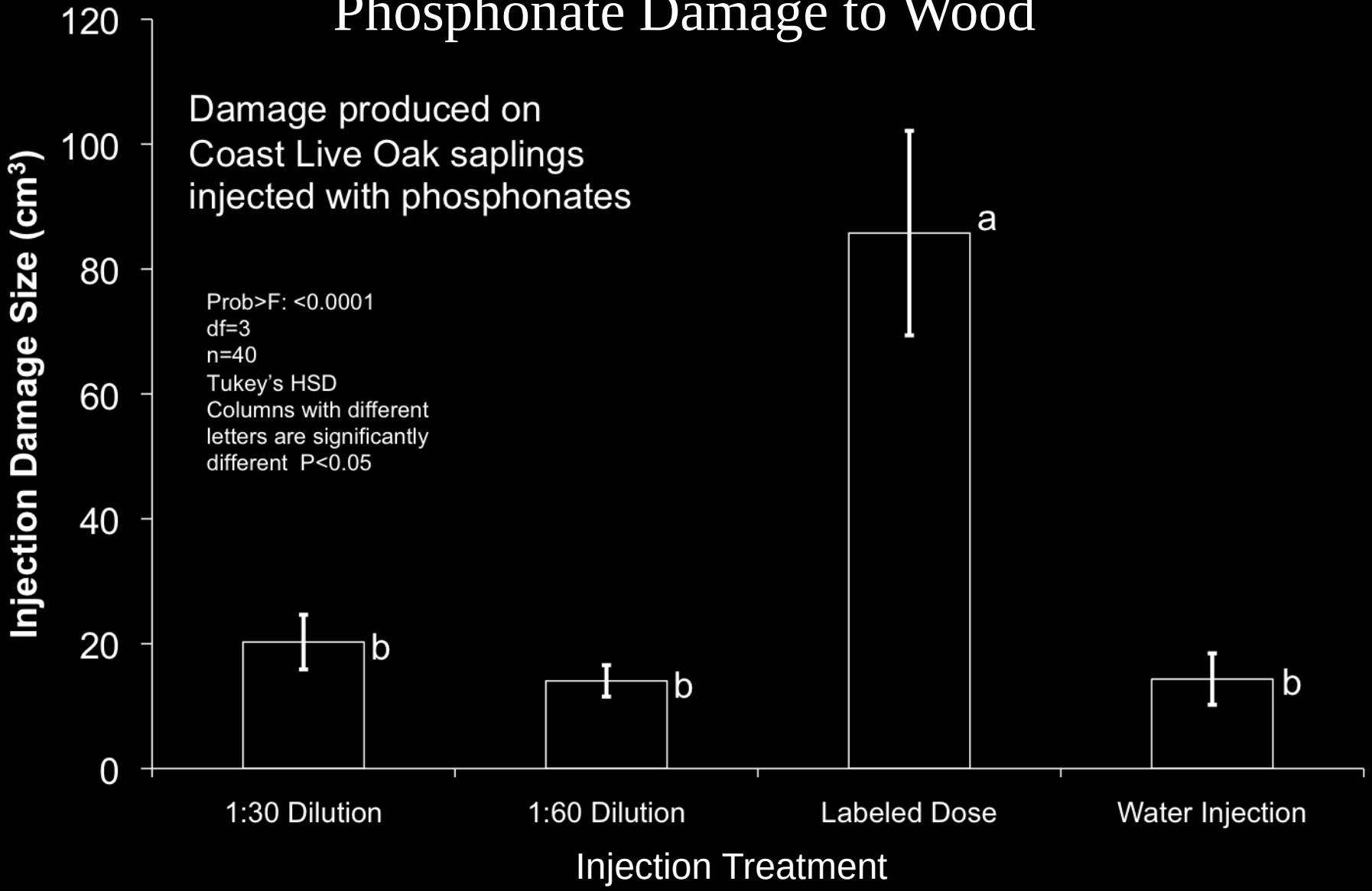
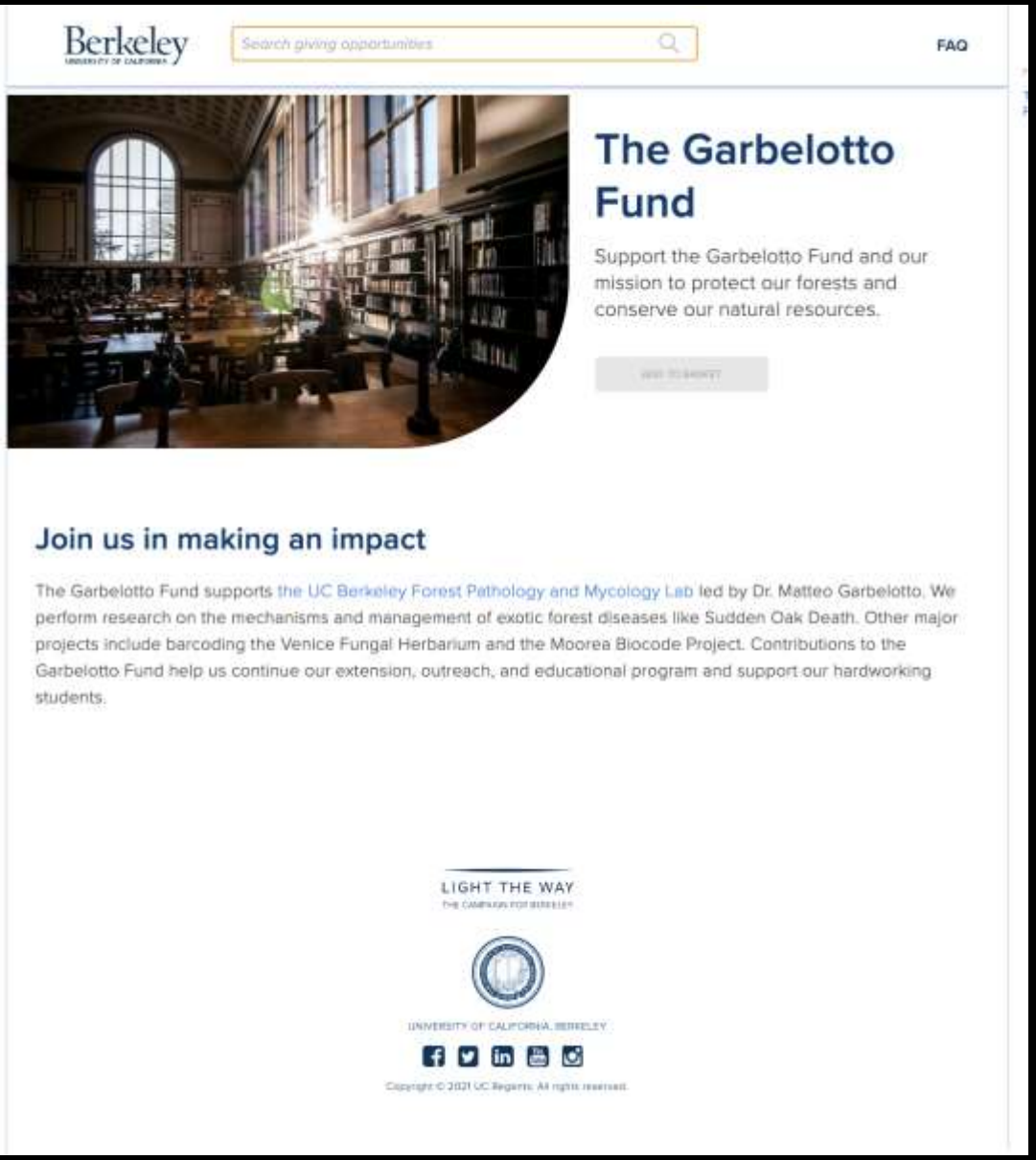


Figure 2. Injection damage caused by labeled dose vs updated dilution ratios. Note that updated dosage damage is indistinguishable from damage caused by only injecting water.

Important websites

- www.sodblitz.org SOD blitzes 2020 & soon 2021
- www.sodmap.org all data on SOD
- Sodmap mobile (App) all data on SOD plus risk calculator
- www.oaskstep.org how to diagnose oaks with SOD
- www.sodquest.org let us know what you have done to control SOD



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www.matteolab.org

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