SOD Blitzes 2015

UC Berkeley Forest Pathology and Mycology Laboratory & CNPS

www.matteolab.org

www.thanqs.org

www.sodblitz.org

www.sodmap.org

www.sodmapmobile.org

Thanks to funding from:

- State and Private Forestry, US Forest Service
- Pacific Southwest Station, US Forest Service
- The PG&E Foundation
- National Science Foundation

Two publications
www.matteolab.org

- SOD map and SOD map mobile
- Citizen science data as good as scientists' data: sod blitz info used to generate predictive model. The model shows likelihood of SOD infection is positively correlated to precipitation, bay density, and infection level of previous year, and negatively corelataed to max average temp and population density

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*.

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

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.

Citizen science helps predict risk of emerging infectious disease

Ross K Meentemeyer[1,2*], Monica A Dorning[2], John B Vogler[2], Douglas Schmidt[3], and Matteo Garbelotto[3,4]

Engaging citizen scientists is becoming an increasingly popular technique for collecting large amounts of ecological data while also creating an avenue for outreach and public support for research. Here we describe a unique study, in which citizen scientists played a key role in the spatial prediction of an emerging infectious disease. The yearly citizen-science program called "Sudden Oak Death (SOD) Blitz" engages and educates volunteers in detecting the causal pathogen during peak windows of seasonal disease expression. We used these data – many of which were collected from under-sampled urban ecosystems – to develop predictive maps of disease risk and to inform stakeholders on where they should prioritize management efforts. We found that continuing the SOD Blitz program over 6 consecutive years improved our understanding of disease dynamics and increased the accuracy of our predictive models. We also found that self-identified non-professionals were just as capable of detecting the disease as were professionals. Our results indicate that using long-term citizen-science data to predict the risk of emerging infectious plant diseases in urban ecosystems holds substantial promise.

Front Ecol Environ 2015; 13(4): 189–194, doi:10.1890/140299

Mitigating threats to biodiversity and ecosystem function from unexpected outbreaks of emerging infectious disease hinges on scientists' ability to detect and predict disease spread across broad spatial extents in a timely manner (Crowl *et al.* 2008). The economic cost of collecting sufficient data to develop empirical models of non-human diseases, such as those affecting plants and wildlife in ecological communities, is often prohibitive but may be offset by involving volunteer citizen scientists in the data collection process. Citizen-science programs offer promising new approaches for increasing the extent and frequency of sampling efforts (Dickinson *et al.* 2012). For example, the world is beginning to see potential for accelerated responses to natural disasters – through rapid compilation of volunteered geographic information at the forefront of an event (Goodchild and Glennon 2010). Currently, engaging citizen volunteers in collecting timely georeferenced data on the spread of emerging pathogens is an under-explored opportunity that could be used to help predict disease risk while simultaneously educating the public about disease control and prevention and involving stakeholders in the scientific and planning processes (Dickinson *et al.* 2012).

Citizen scientists are increasingly being called upon to survey the abundance and distribution of organisms (see review in Dickinson *et al.* 2010), but with few notable applications focused on pests and pathogens (eg ZomBee Watch, House Finch Disease Survey). When responding to the threat of emerging diseases, the goal is often not just to monitor spread but to predict locations where future outbreaks are imminent. However, predictive models are only as good as the available data and, as such, concerns about increased observer error and sampling bias in citizen-science observations are still common (Crall *et al.* 2011; Kremen *et al.* 2011). Fortunately, assessment of data quality and adequate training for volunteers can reduce observer error (Gardiner *et al.* 2012), and targeted sampling strategies can limit sampling bias (Dickinson *et al.* 2010). Targeted approaches are especially useful for analyzing seasonal events and directing data collection to coincide with peak windows for observation (eg timing of disease expression, flight of migratory birds). Citizen-science programs that limit observer error and sampling bias through targeted sampling techniques and well-designed volunteer training sessions can also produce extensive datasets that are critically needed for predicting disease spread with empirical models.

Using the Sudden Oak Death (SOD) Blitz program (www.sodblitz.org) as a case study, we focus on two questions that shed light on the value of citizen science augmented with geographic information and crowdsourcing (collecting data by soliciting contributions from the public) for responding to emerging infectious diseases: (1) does the SOD Blitz improve our understanding of pathogen habitat and our ability to predict disease risk?, and (2) did the educational background and professional experience of our citizen-science participants affect the probability of disease detection? The presence of SOD is a major public concern in coastal California and Oregon due to the widespread mortality of millions of socially and ecologically important trees. SOD is caused by the generalist and invasive plant pathogen *Phytophthora ramorum*,

[1]*Department of Forestry and Environmental Resources, North Carolina State University, Raleigh, NC* *(rkmeente@ncsu.edu); [2]*Center for Geospatial Analytics, North Carolina State University, Raleigh, NC*; [3]*Forest Pathology and Mycology Laboratory, University of California–Berkeley, Berkeley, CA*; [4]*Department of Environmental Science, Policy, and Management, University of California–Berkeley, Berkeley, CA*

Citizen science generated the best predictive model for disease spread

The accuracy of the model improved with each year

Average maximum temp and population density are negatively correlated with spread, while rainfall, bay density, and infection of previous year are positively correlated

Fall trainings
(SOD Blitz results and)

- New Injection Label
- Soil amendments
- Scribing
- Silvicultural prescriptions

Sudden Oak Death

Exotic pathogen introduced in several areas on infested ornamental stock (late 80s)

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

Need to have a fine-scale map of pathogen distribution



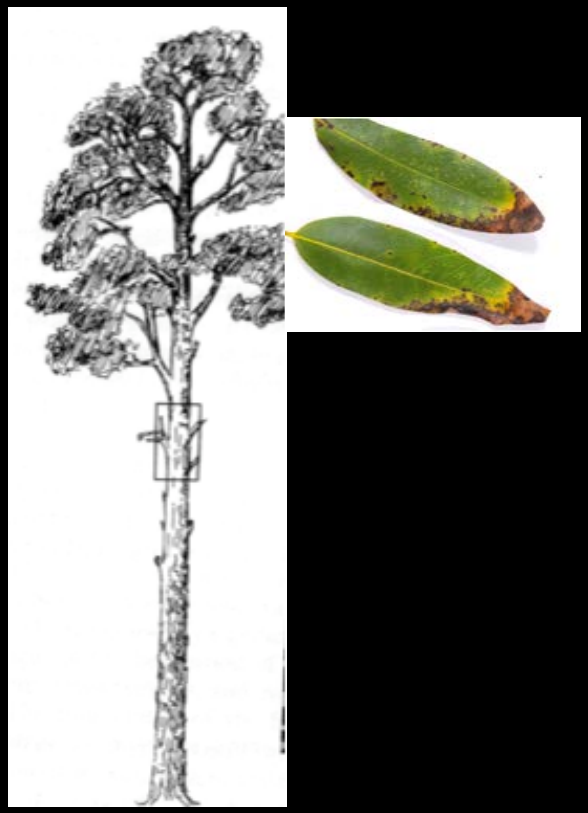


SOD Blitzes

- 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
- 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

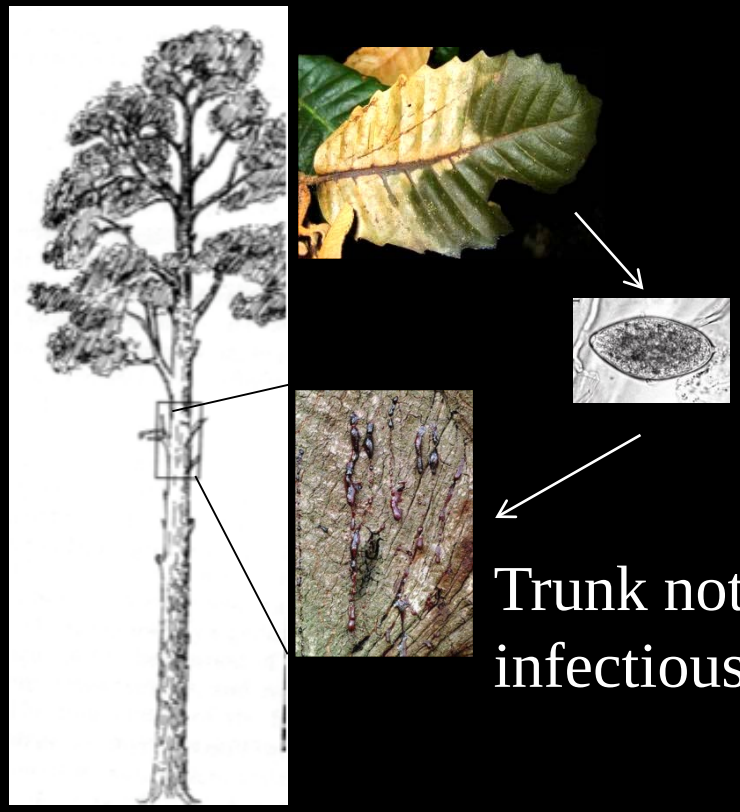
Infectious hosts in CA forests

- CA Bay Laurel



Only leaves,
highly infectious

- Tanoaks



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

Bay/Oak association

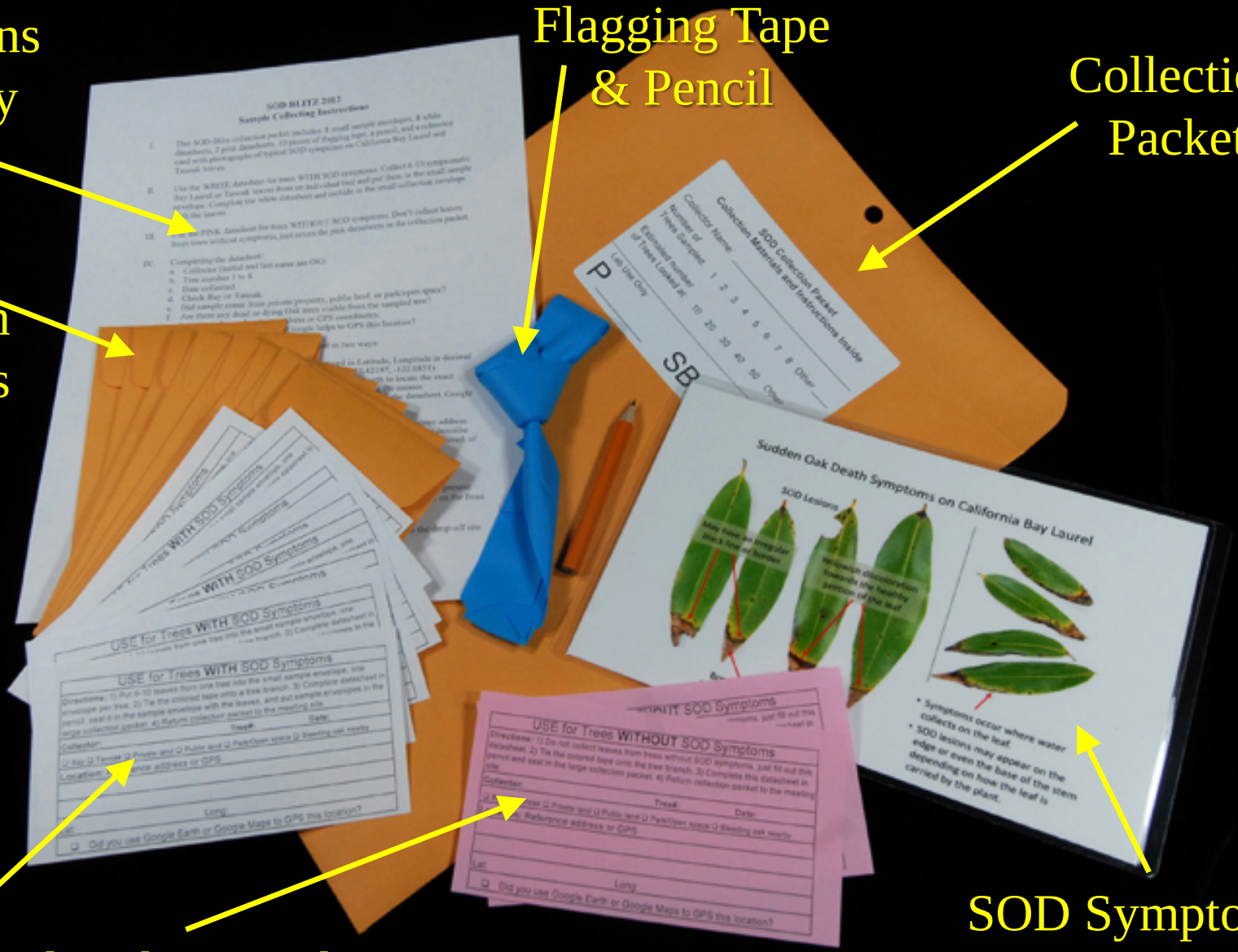
Yearly, in spring

Coast Live Oak (no sporulation)

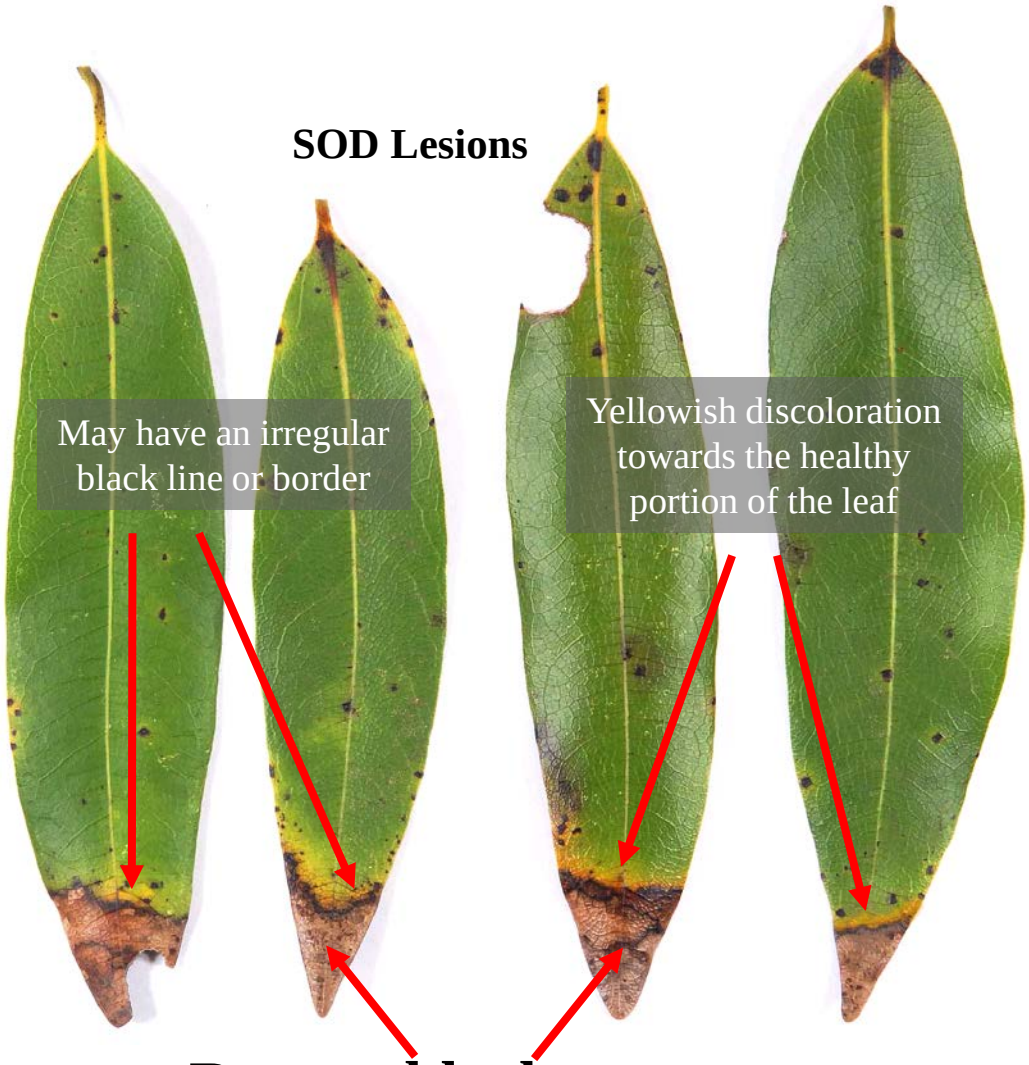
Wave years

Soil/Water

SOD Blitz 2014 Collection Materials



Sudden Oak Death Symptoms on California Bay Laurel

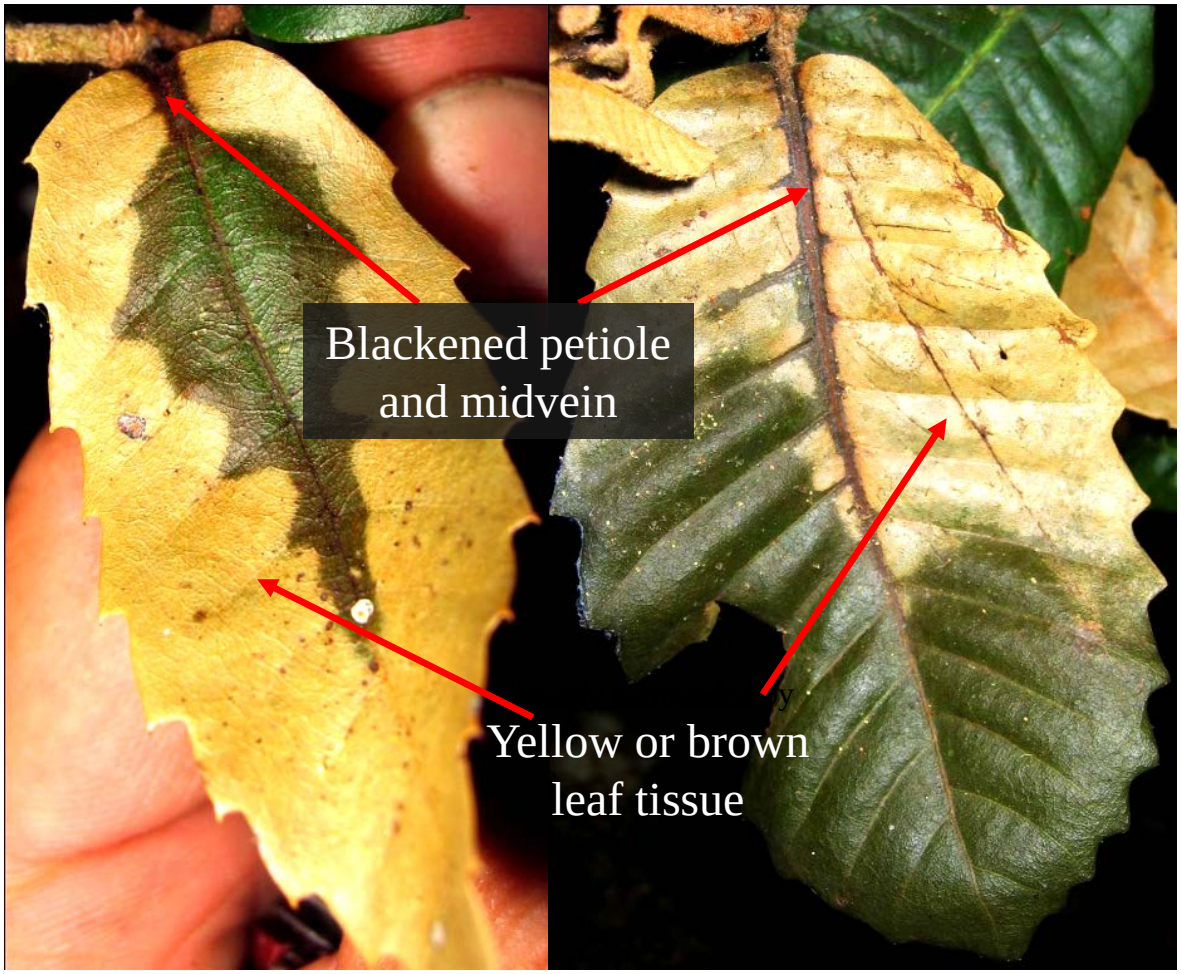


- Symptoms occur where water collects on the leaf.
- SOD lesions may appear on the edge or even the base of the stem depending on how the leaf is carried by the plant.

More on bay laurel symptoms

- Not all leaves will display symptoms (as few as one leaf may have them)
- Usually in lower canopy (thank god!)
- Look at each side of tree for 20 seconds before making your decision
- Mark on large envelope how many healthy and symptomatic trees you look at, as you are doing it

SOD Symptoms on Tanoak



Asymptomatic Tanoak

Leaf blotches on tanoak
that are not SOD

1-Collect Leaves

2-Put Leaves in small envelope

3-Flag Tree

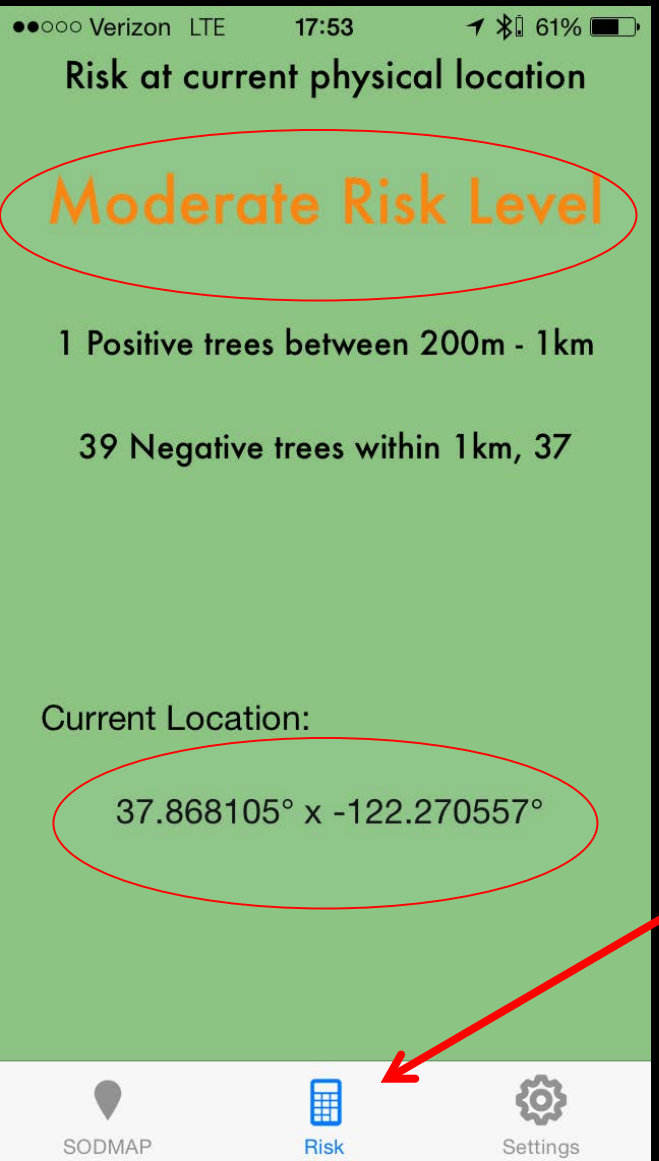
4-GPS: to identify location

SODmap Mobile:

SODMAP Mobile

U.C. Berkeley
Forest Pathology
and Mycology
Laboratory

We recommend using the free app SODmap Mobile to map your trees with your iPhone or Android device!

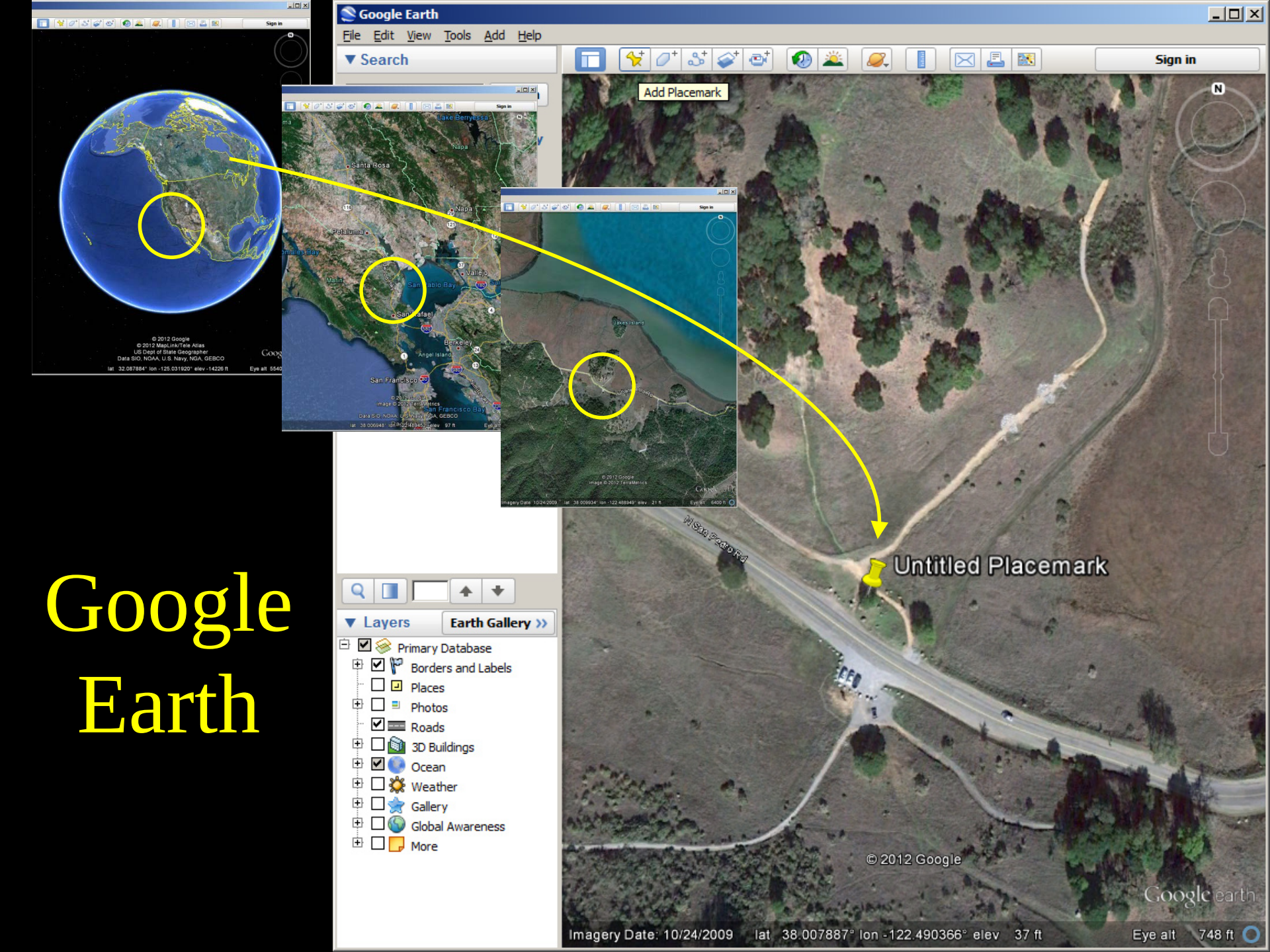


Available on iTunes and Google Play

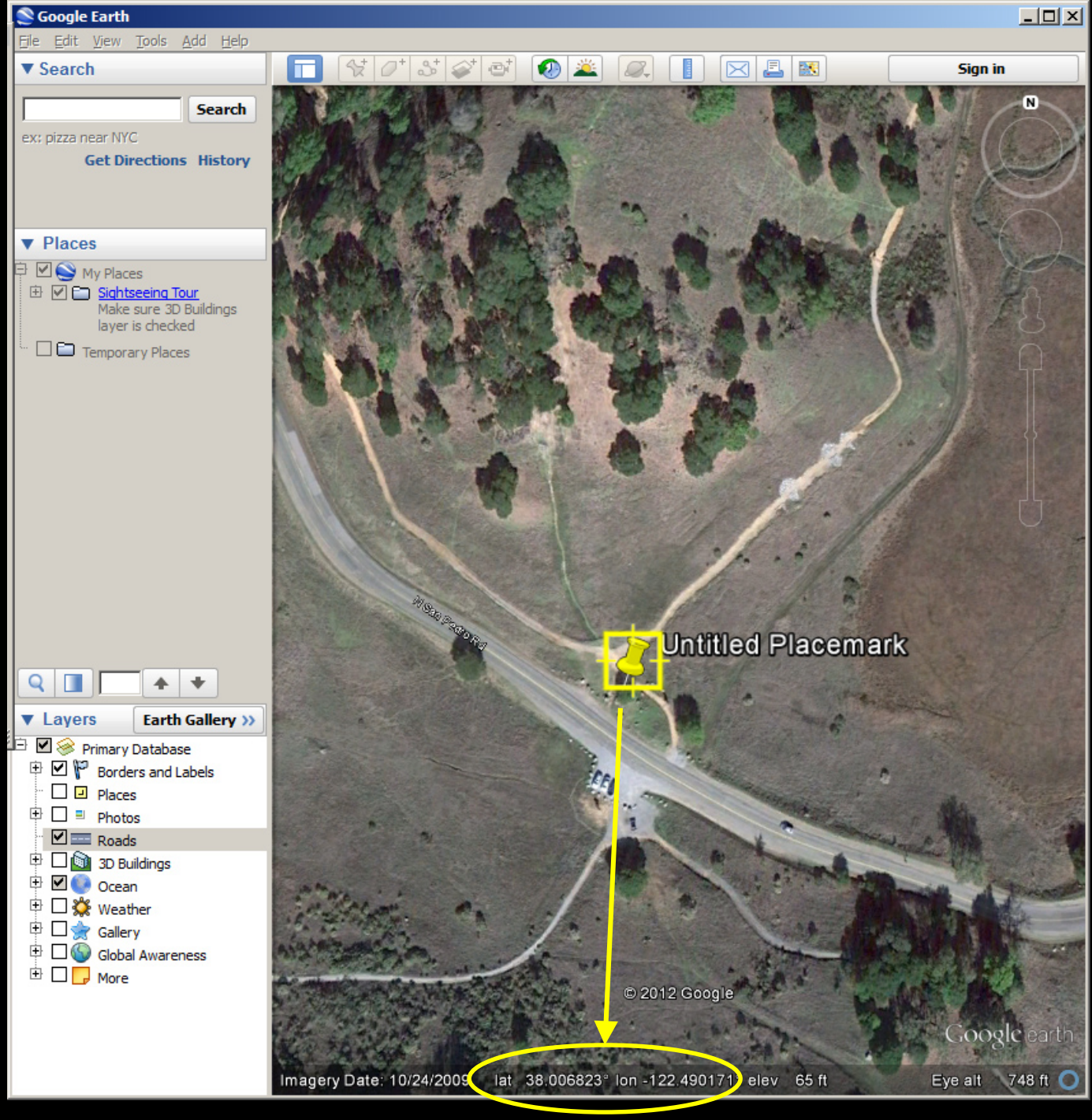
Tapping the Risk button will give you the Lat, Long, and Risk of your current location

If a GPS/smartphone is not available:

- On the small collecting envelope or datasheet, write down as much as you can to help you remember where each sample was collected (address, side of street, landmarks)
- At home, download and turn on Google Earth
- Redo your collecting walk on the computer
- Put the mouse on the estimated location of a tree you sampled
- At the bottom of the page, you will see Lat. and Long.


Google Earth
File Edit View Tools Add Help
Search
Sign in
Add Placemark
Untitled Placemark
Layers
Earth Gallery
Primary Database
Borders and Labels
Places
Photos
Roads
3D Buildings
Ocean
Weather
Gallery
Global Awareness
More
© 2012 Google
Google earth
Imagery Date: 10/24/2009 lat 38.007887° lon -122.490366° elev 37 ft Eye alt 748 ft
Google
Earth

Record GPS coordinates



If field GPS/smartphone and Google Earth are not available:

- Estimate direction and distance of your first sampled tree from a driveway with address

-For example: define the location of your first tree (#1) as “100 m Southeast of driveway at 123 Park Lane, Saratoga”

- Estimate the location of your second tree with direction and distance away from your first tree, and so on

-For example: tree #2 = “100 m East of tree #1”

Two major strategies for sampling:

Sampling scheme 1

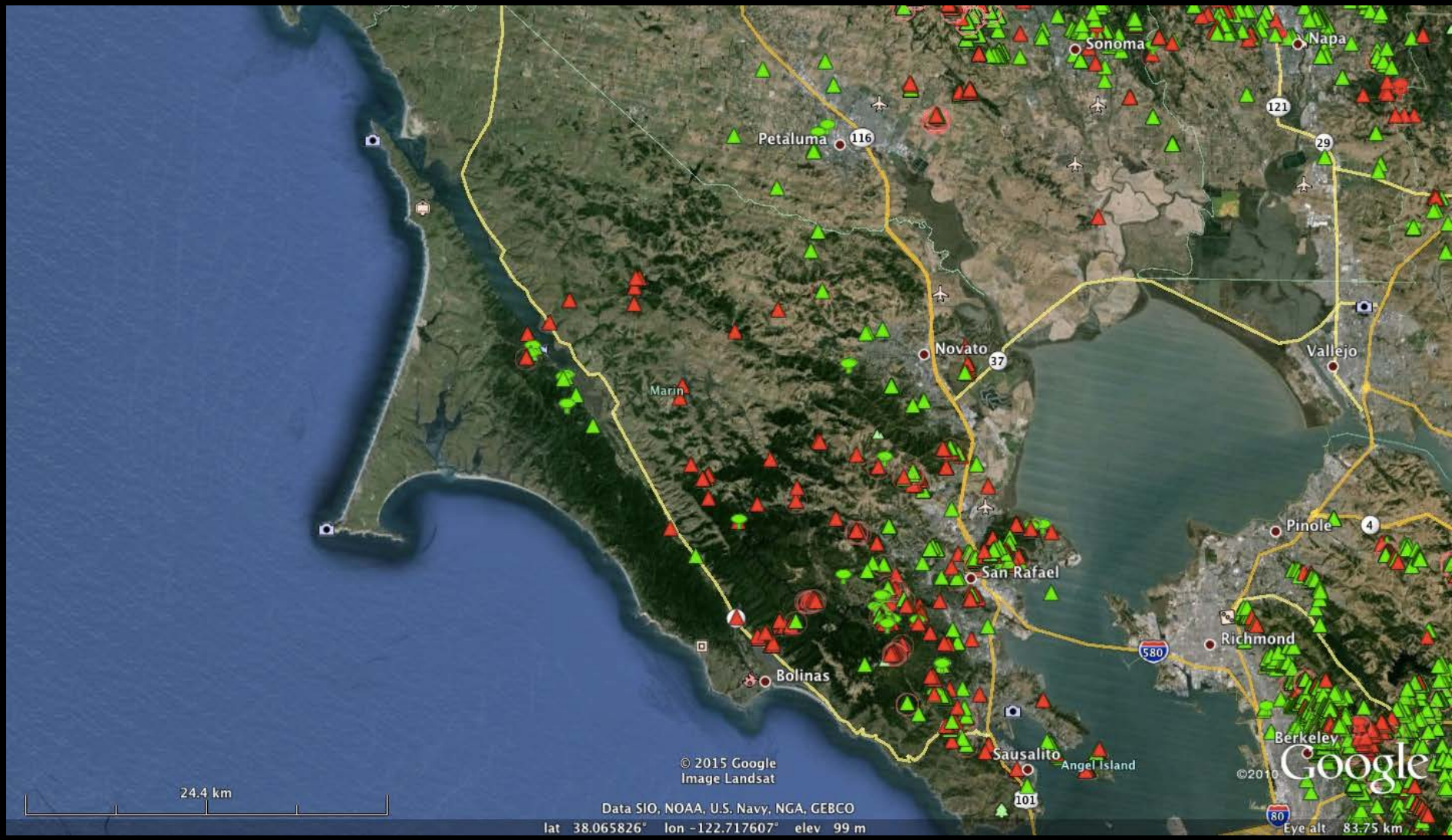
- To identify new infestations: sample symptomatic plants, sampling distance can be variable but 50-100 yards optimal

Sampling scheme 2

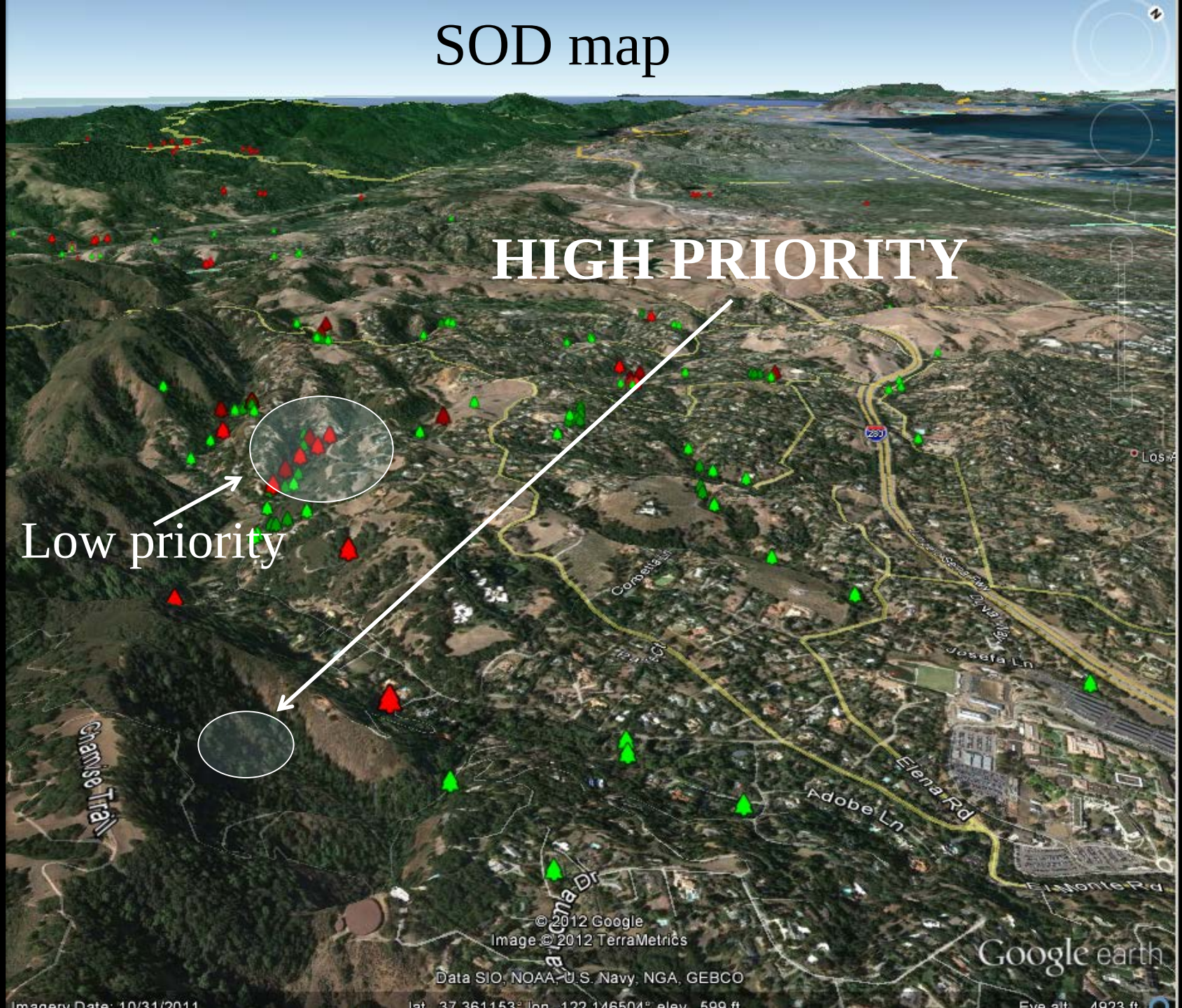
- Determine also disease intensity. Sample at closer intervals 5-10 yards. Ideal if SOD outbreak already confirmed

To identify new infestations (Sampling Scheme 1)

- Sample any area you are curious about, or care about
- Areas with little information based on SODmap, sampling interval between trees about 100 m
- Use SODmap Mobile


Sonoma
Napa
Petaluma
116
121
29
Novato
37
Vallejo
Marin
Pinole
4
San Rafael
Richmond
580
Bolinas
Berkeley
Sausalito
Angel Island
101
80
© 2015 Google
Image Landsat
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
24.4 km
lat 38.065826° lon -122.717607° elev 99 m
Eye alt 83.75 km
Google

SOD map

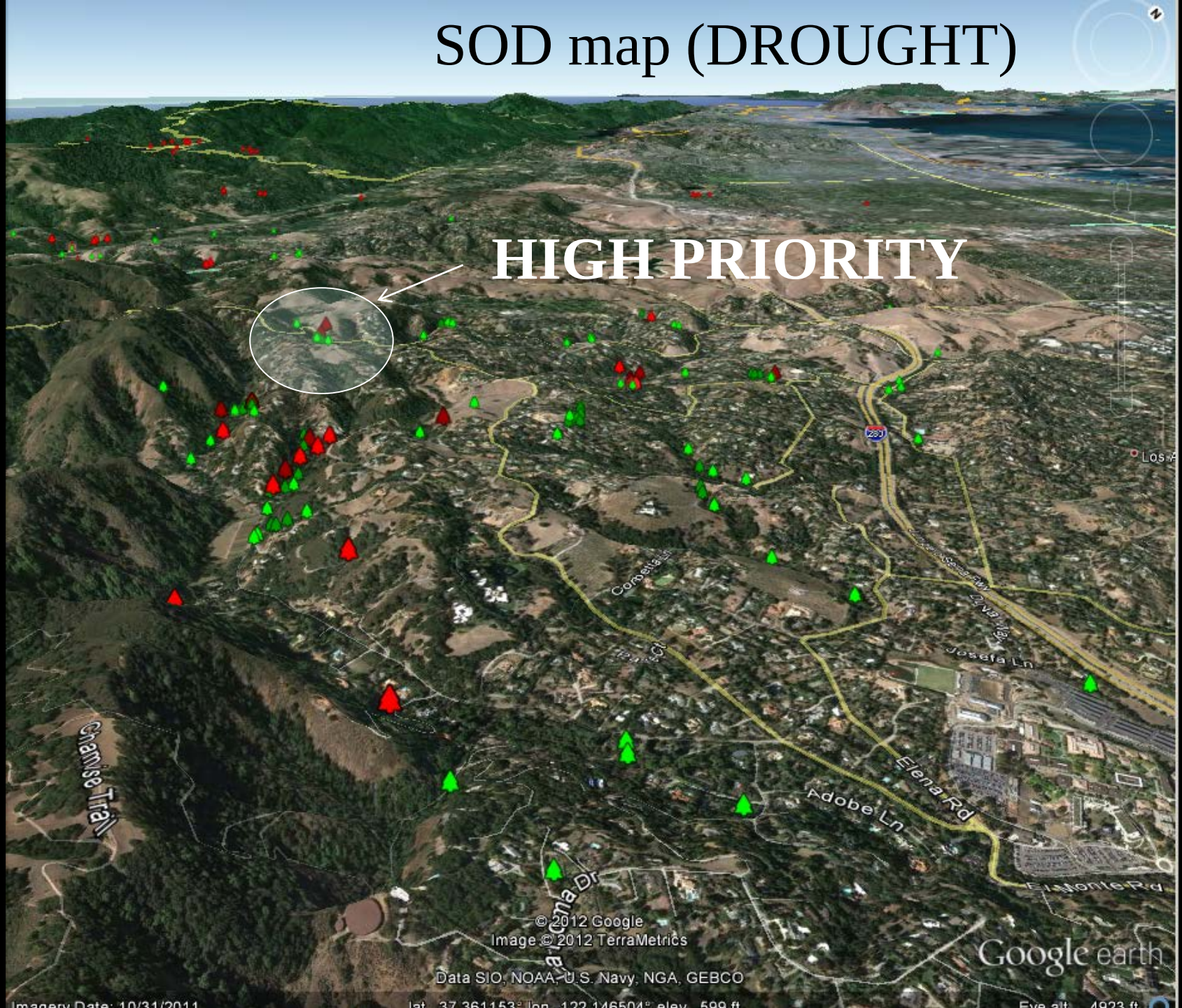

HIGH PRIORITY
Low priority
Chamisa Trail
Elena Rd
Adobe Ln
Josefa Ln
Elena Dr
© 2012 Google
Image © 2012 TerraMetrics
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Google earth

Four different risk levels

High priority for sampling

Low priority for sampling

SOD map (DROUGHT)



Determine disease intensity Sampling Scheme 2

- Find trees that were positive in 2014 or 2013 on Sodmap Mobile or on computer (www.sodblitz.org) and sample the same bay laurel and other bay laurels at distances of at least 5 m

- **Tag and GPS each tree**

If bays abound

5-10 m

If bays scarce

5-10 m

Installation of Tree Tags (recommended for intensive sampling)

Install on north side of tree,
1.5 m above ground

Leave room for tree growth

Use **White** Labels for Trees with SOD Symptoms

Use **White** Labels for Trees with SOD Symptoms

10 per packet

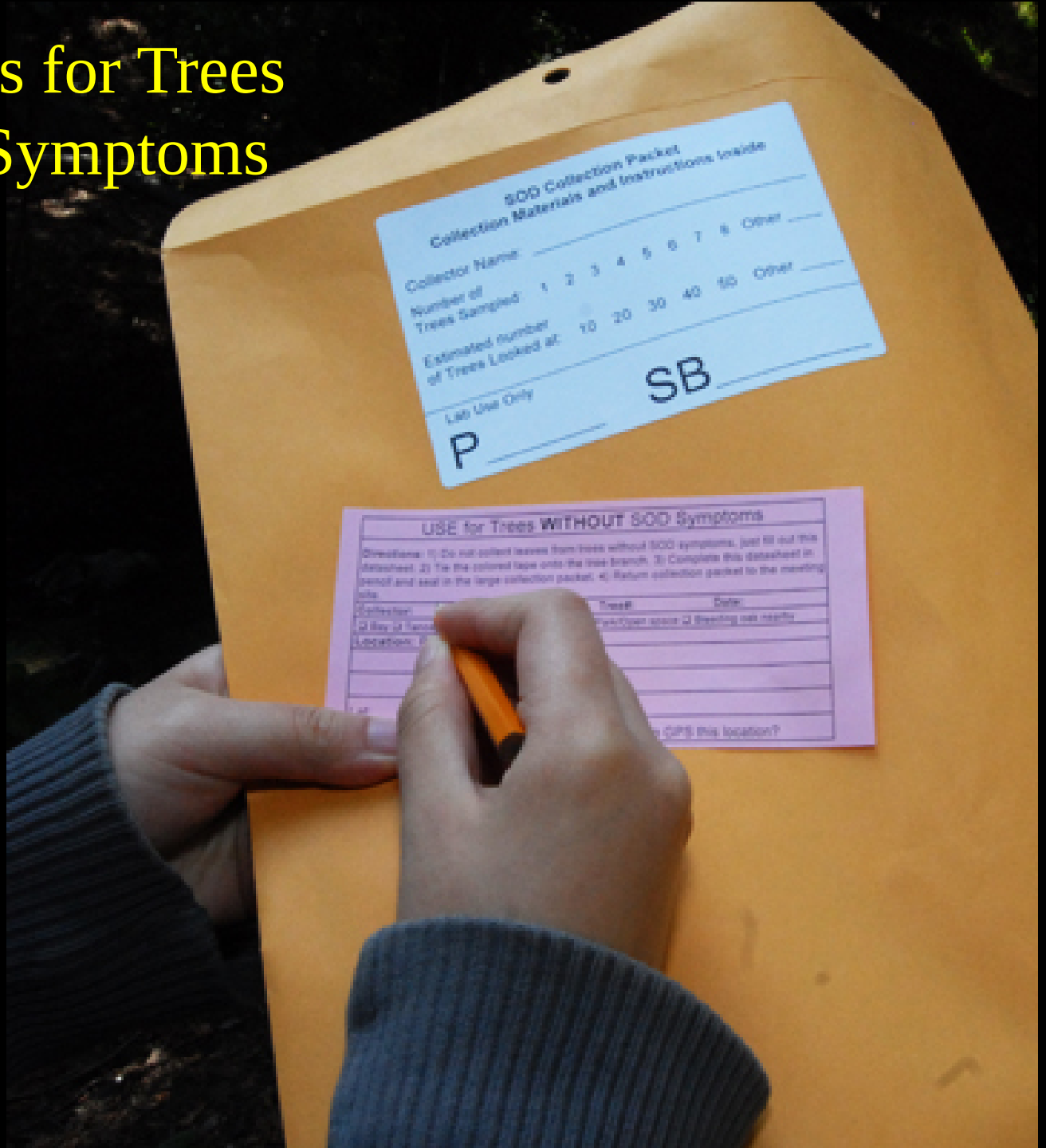
Use for Trees **WITH** SOD Symptoms
Directions: 1) Put 6-10 leaves from one tree into the small sample envelope, one envelope per tree. 2) Tie the colored tape onto a tree branch. 3) Complete datasheet in pencil, seal it in the sample envelope with the leaves, and put sample envelopes in the large collection packet. 4) Return the collection packet to the meeting site.
Collector: **Tree#:** **Date:**
❑ **Bay** ❑ **Tanoak** **Metal Tree Tag # (optional):**
❑ **Private land** ❑ **Public land** ❑ **Park/Open space** ❑ **Symptomatic oak nearby?**
Location:
Lat: **Long:**
❑ Did you use Google Earth or Google Maps to GPS this location?

Do NOT round off numbers for Lat. and Long.

Look for symptoms on oaks(tanoaks) near bay trees

Viscous
Good smell
Black to amber
No wounds
(Lower trunk)

Use **Pink** Labels for Trees without SOD Symptoms



Use **Pink** Labels for Trees without SOD Symptoms

Use for Trees **WITHOUT** SOD Symptoms		
Directions: 1) Do not collect leaves from trees without SOD symptoms, just fill out this datasheet. 2) Tie the colored tape onto the tree branch. 3) Complete this datasheet in pencil and seal in the large collection packet. 4) Return the collection packet to the meeting site.		
Collector:	**Tree#:**	**Date:**
❑ **Bay** ❑ **Tanoak**	**Metal Tree Tag # (optional):**	
❑ **Private land** ❑ **Public land** ❑ **Park/Open space** ❑ **Symptomatic oak nearby?**		
Location:		
Lat:	**Long:**	
❑ Did you use Google Earth or Google Maps to GPS this location?		

SOD Blitz 2013 Collection Packet
Collection Materials and Instructions Inside

Collector : _____

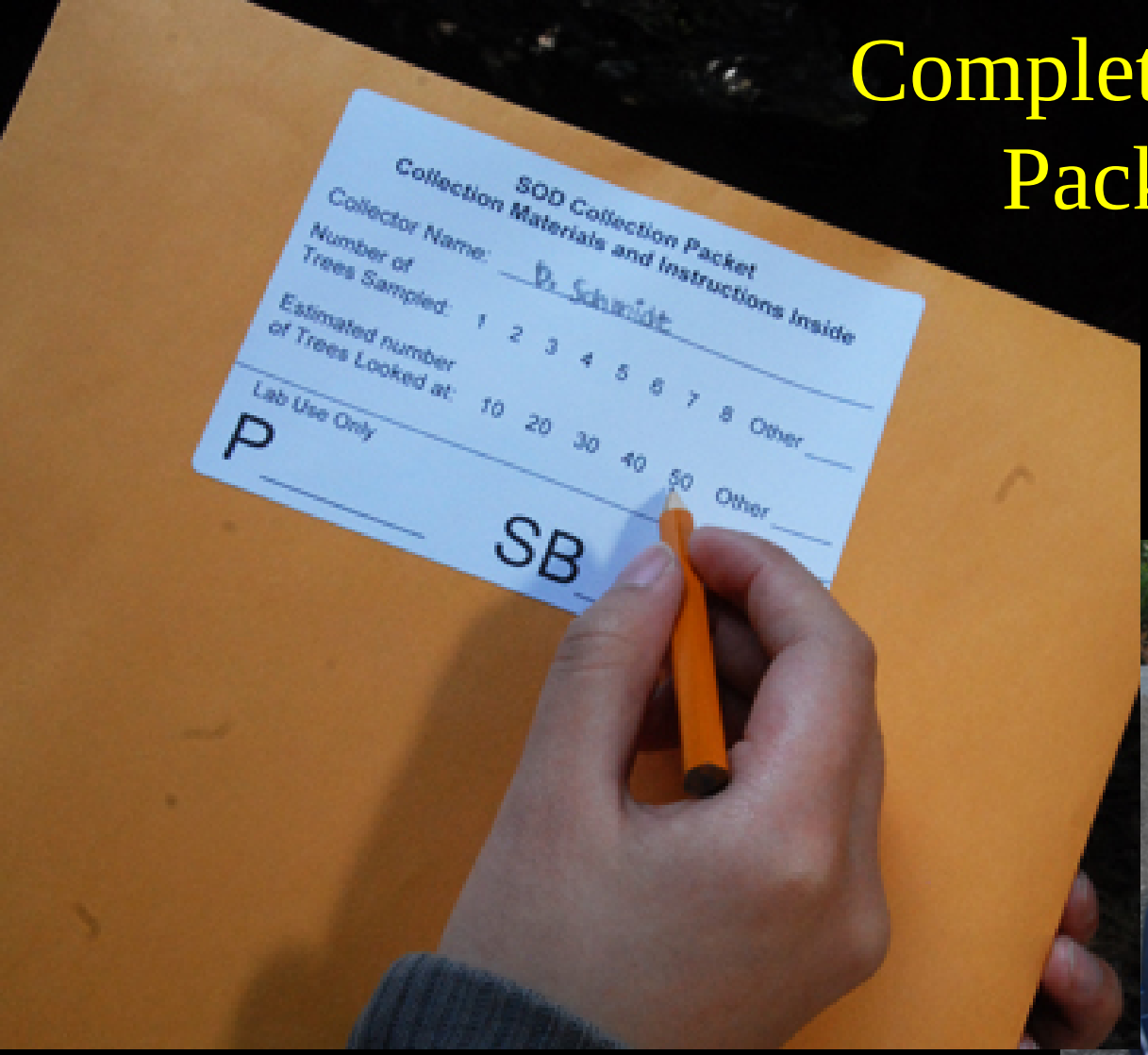
Estimated Number of Healthy Trees
you Looked at to Make This Collection: _____

Estimated Number of Symptomatic Trees
you Looked at to Make This Collection: _____

Lab Use Only

P_____ SB_____

Complete Collection Packet Label



Return Samples to Collection Site

Important notes when collecting:

- Keep samples in cool, shady spots
- Do not expose to sunlight or heat (do not leave in cars!)
- Do not put in freezer (fridge also not recommended)
- Return packets to the collection box by the deadline

After collecting:

- Do not bring any plant material home with you besides what you collected for the BLITZ once it has been placed in the collecting envelopes inside the large manila envelope

- Clean all mud from shoes; if possible use brush on site

- If very muddy, change shoes as you get to car and then wash in tub or sink at home. Do NOT scrub in your yard.

THANK YOU!

Program funded by USFS State & Private Forestry, NSF, and the PG & E Foundation

Your Local Blitz Organizer(s)

Doug Schmidt and Toni Mohr at UCB + dedicated undergrads

SOD Blitzes 2015

Useful urls:

www.matteolab.org

www.thanqs.org

www.sodblitz.org

www.sodmap.org

www.sodmapmobile.org

THANQs – FAQ

Tree Health Answers & Questions

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

Forest Health

- Can the Garbelotto lab analyze wood chips for pathogens?
- Armillaria is slowly killing my Thuja hedge. What is a comparable replacement hedge that will give me the same amount of privacy and be resistant to this fungus?
- If the stump of a felled tree is left in place, can the roots to continue to grow?
- Can coast live oak be used in a large-scale Bay Area tree planting project without exacerbating SOD?

General Tree Care

- When should I remove a tree?
- What is the Critical Root Zone around a tree?
- Will fresh wood chip mulch injure the general health of a tamarack tree?
- Can the Garbelotto lab analyze wood chips for pathogens?
- Armillaria is slowly killing my Thuja hedge. What is a comparable replacement hedge that will give me the same amount of privacy and be resistant to this fungus?
- If the stump of a felled tree is left in place, can the roots to continue to grow?

Featured

Podcast: SAS Institute

SOD: Cleaning Tools & Equipment

Question Submission Form