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December 10, 2014

Sudden Oak Death in the Redwood Creek Watershed and Potential Drought Impacts

Funding provided by:
USDA Forest Service, State and Private Forestry and SOD Research,
American Recovery and Reinvestment Act, CAL FIRE

Quercus species (true oaks)



Photo: Lenya Quinn-Davidson; white oak in the Bald Hills

- **White oak NOT susceptible!!**
- Oaks in the red oak group *are* susceptible
 - Black oak (present in RNP)
 - Coast and canyon live oak
- Generally considered “dead end” hosts
 - Require a neighboring host that is capable of supporting pathogen spore production to become infected
 - CA bay laurel most important

Tanoak: victim and vector

- Dies from sudden oak death at high rates over time
 - Models suggest average 50% mortality of tanoak in ~10 years from time of initial stand infection
- The pathogen propagates spores on its tissues (twigs and leaves)



Does drought affect pathogen spread?

Although drought can intensify *symptoms*, it may not be affecting spread.

- Total annual precipitation seems to be less of a factor than a combination of rain + temperature (i.e. warm rains).



Investigating the drought ecology of *Phytophthora ramorum* in a California coastal forest

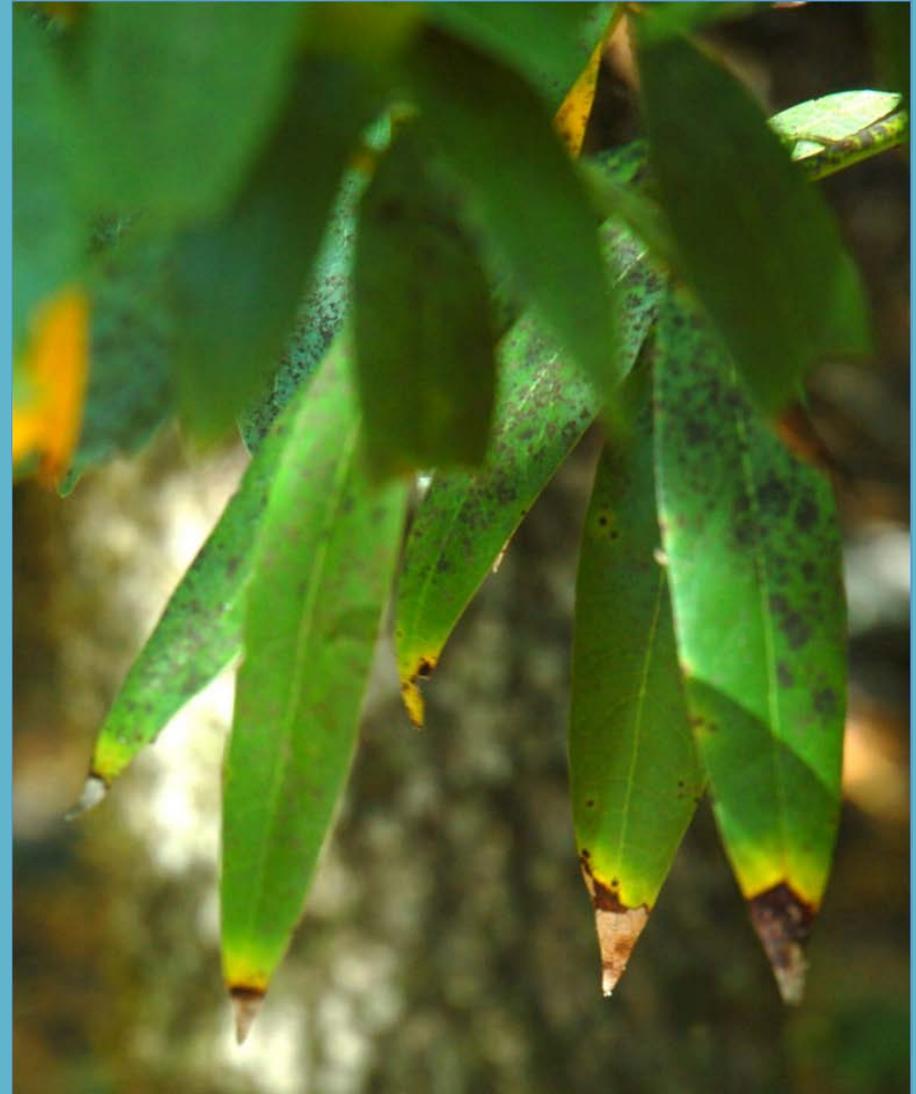
Laura Sims, Melina Kozanitas, Matteo Garbelotto



What happens to *P. ramorum* (*Pr*) infection of bay trees in drought?

Summary:

1. Bay trees carry *Pr* in drought;
2. Areas containing infected bays remain infected;
3. The number of infected bays was reduced in drought but the pathogen remained established as in previous drought;
4. *Pr* populations that expanded to new locations following the drought of 2009 were maintained in the drought of 2014;
5. Bays that were consistently + since 2009, were usually still positive in 2014.





Stream monitoring



Baiting for the pathogen using rhododendron leaves



Stream monitoring

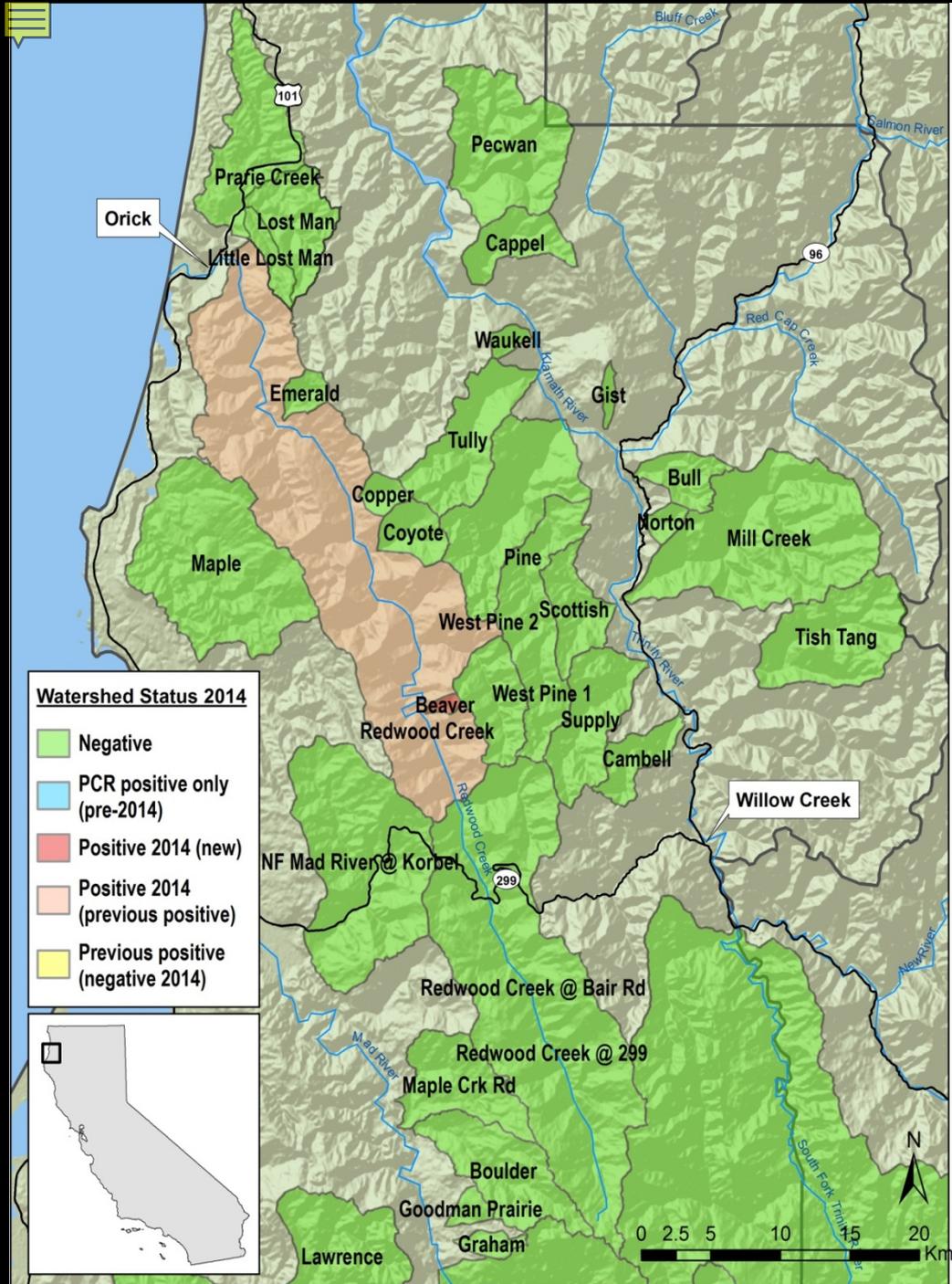
-positive baits indicate pathogen source is upstream

-once we know a stream is positive, where is it coming from?

-collaboration: **UC Davis**, UCCE, Hoopa, Yurok, Humboldt Redwood Co., Green Diamond Res. Co., Del Norte Ag., Redwood Nat'l Park, BLM, Mattole Restoration Council

Watershed Status 2014

- Negative
- PCR positive only (pre-2014)
- Positive 2014 (new)
- Positive 2014 (previous positive)
- Previous positive (negative 2014)



Map courtesy of Clay DeLong, UC Davis

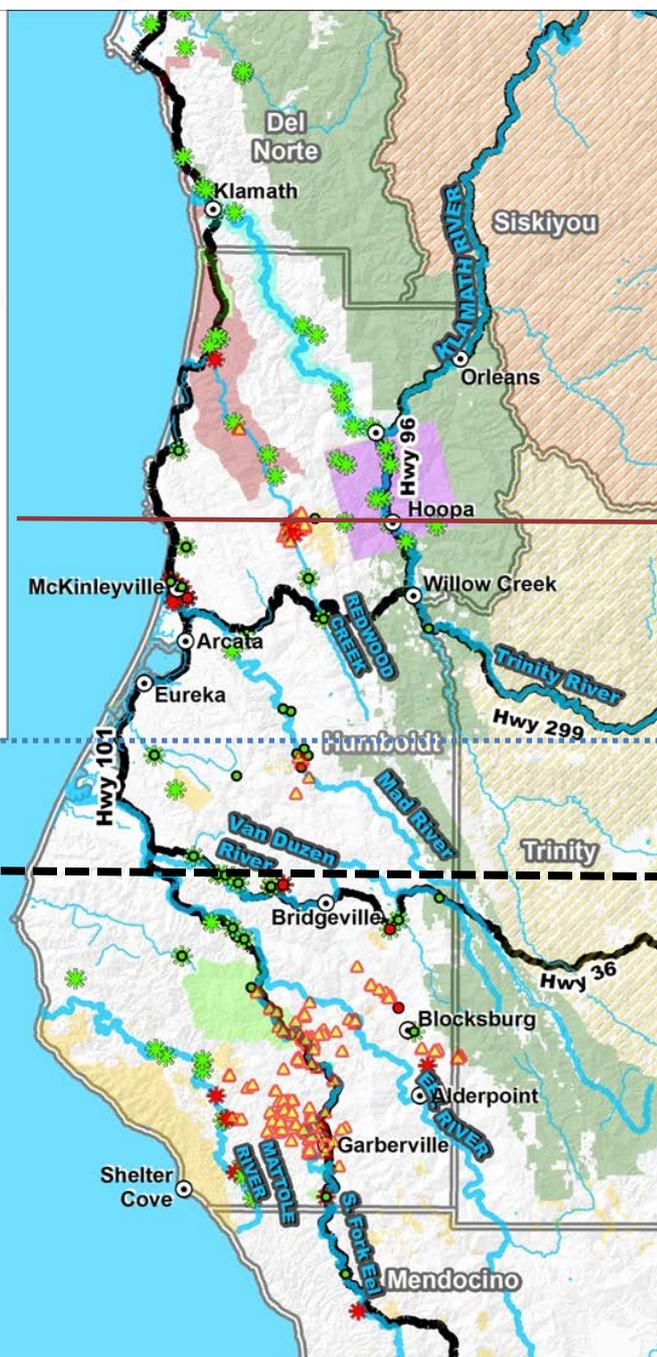
Many modes of pathogen movement

- Via human movement of infected plants
- Wind and rain
- Soil
 - Shoes, tires, and equipment
 - Grow industry
- Water



Humboldt County vicinity locations with confirmed sudden oak death pathogen in streams or vegetation (to Oct 2014)

- ▲ Vegetation w/ SOD pathogen
- Stream Monitoring Stations**
- ★ Positive at least once through 2013
- ★ Negative through 2013
- Negative 2014
- Positive 2014
- Yurok Lands
- State Park, Reserve, or Rec. Area
- Redwood National Park
- Hupa Lands
- Six Rivers NF
- BLM Lands
- Klamath National Forest
- Shasta-Trinity National Forest



RNP personnel surveyed all of RW Creek downstream of this line summer 2014; found Bridge Creek infestation first, then Bond Creek

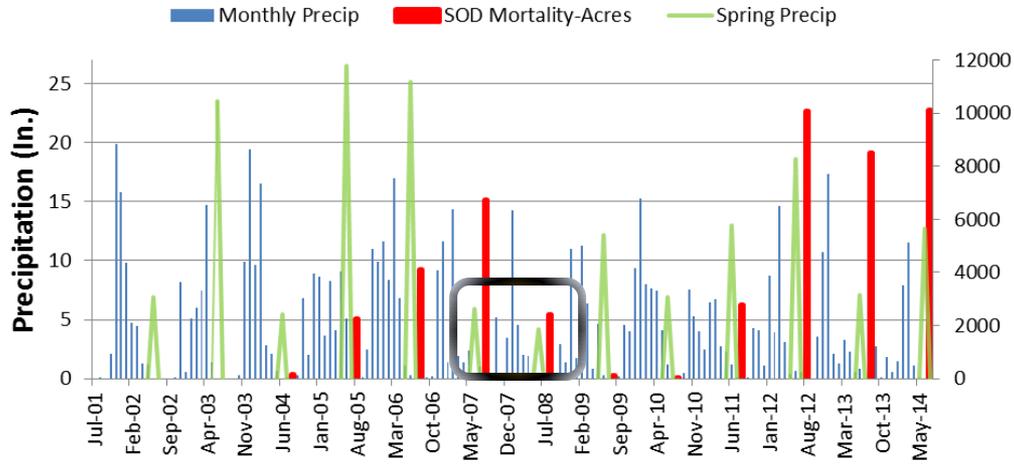
SOD?

Unknown zone: disease may be more widespread than currently known

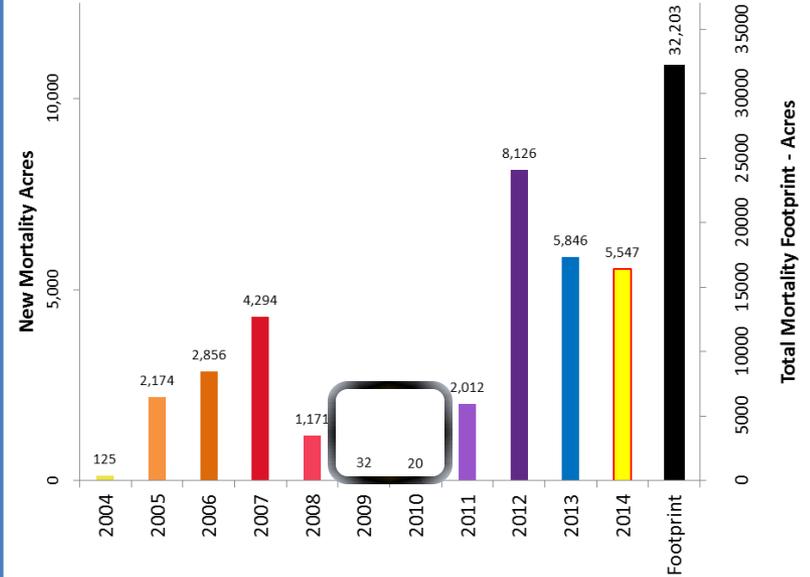
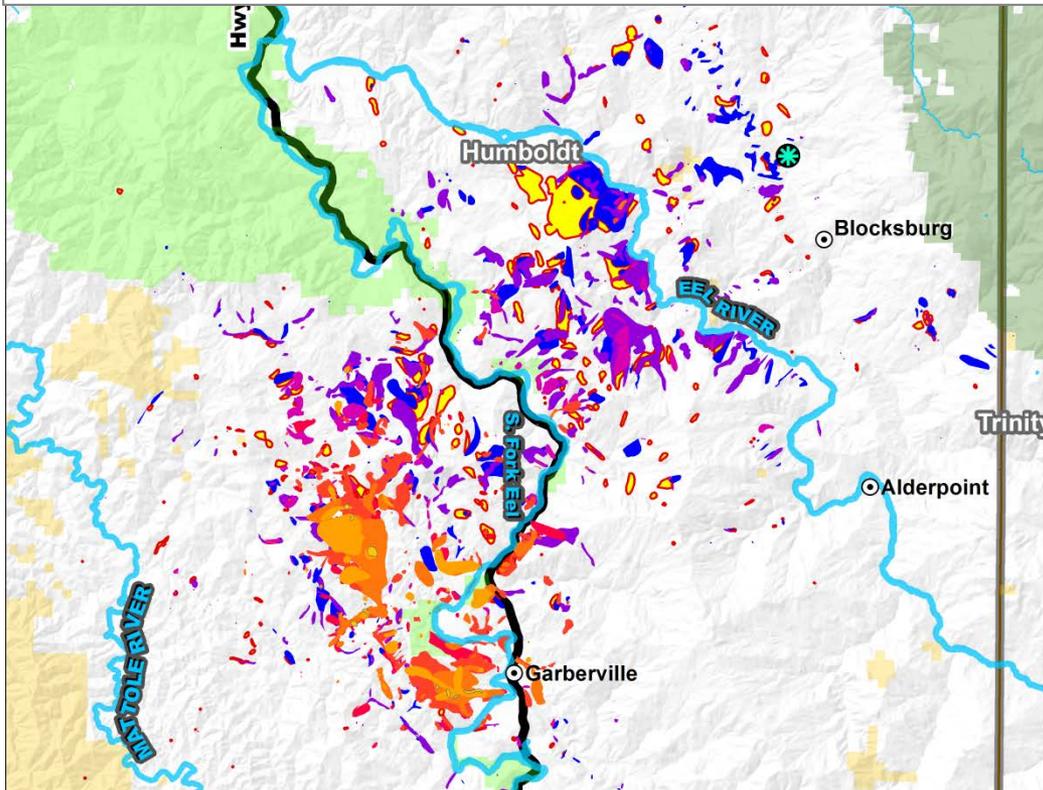
South of this dashed line is where the bulk of contiguous SOD infestation occurs in Humboldt



Redway RAWS Data



Acres of SOD-consistent tanoak mortality identified by USFS Aerial Surveys



**SOD infestation locations
(boundaries approximate);
found summer-fall 2014**

**Redwood
Nat'l Park**

Yurok

Hoopa

**Tanoak and bay
laurel removal
area (2011-2012)**

**4
miles**

**Outer boundary of
currently known SOD
infestation (Oct 2014)**

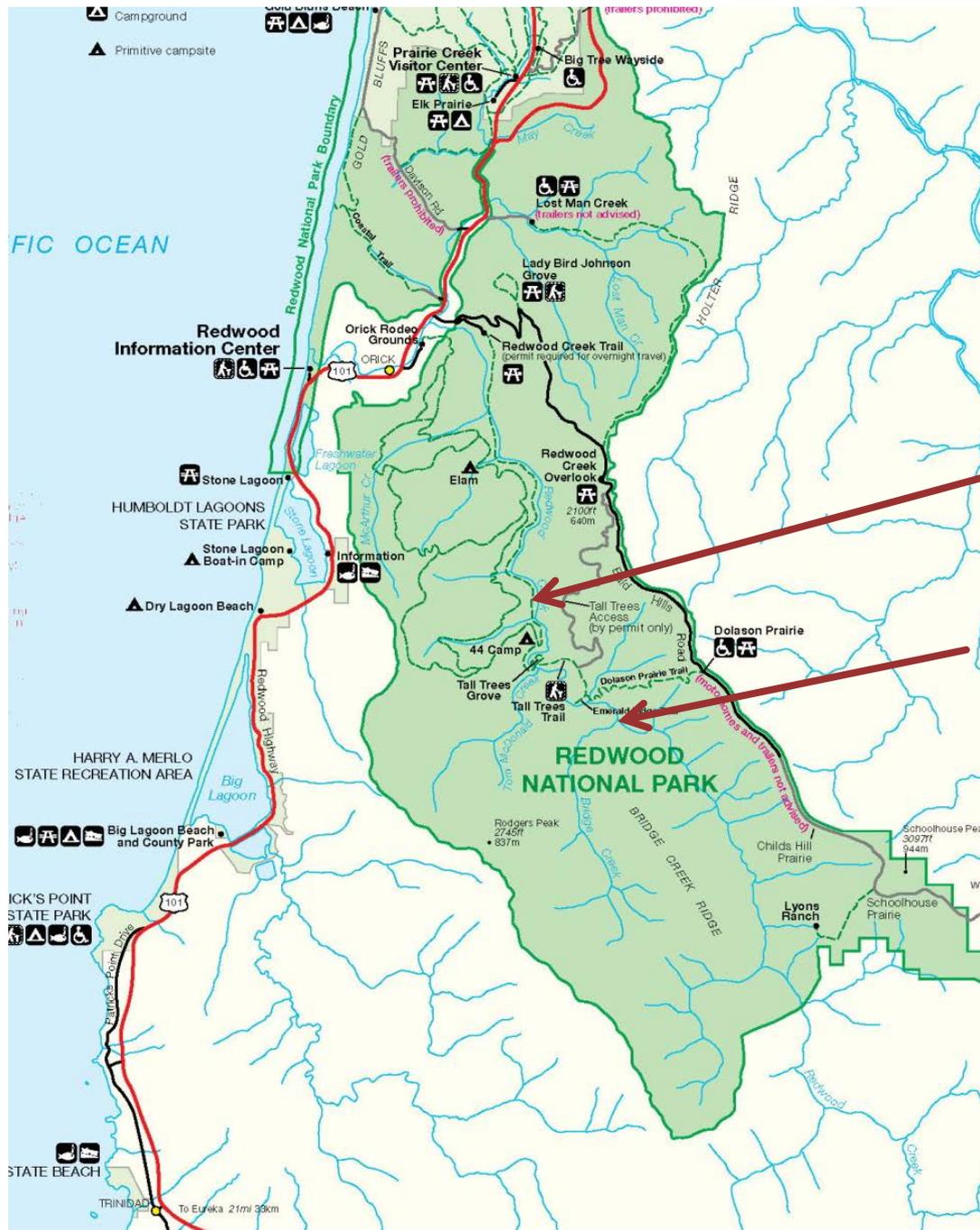
Image Landsat
© 2014 Google

Data SIO, NOAA, U.S. Navy, NGA, GEBCO

Google earth

Imagery Date: 5/28/2014 10 T 426726.39 m E 4550681.65 m N elev 2608 ft eye alt 45279 ft

1993

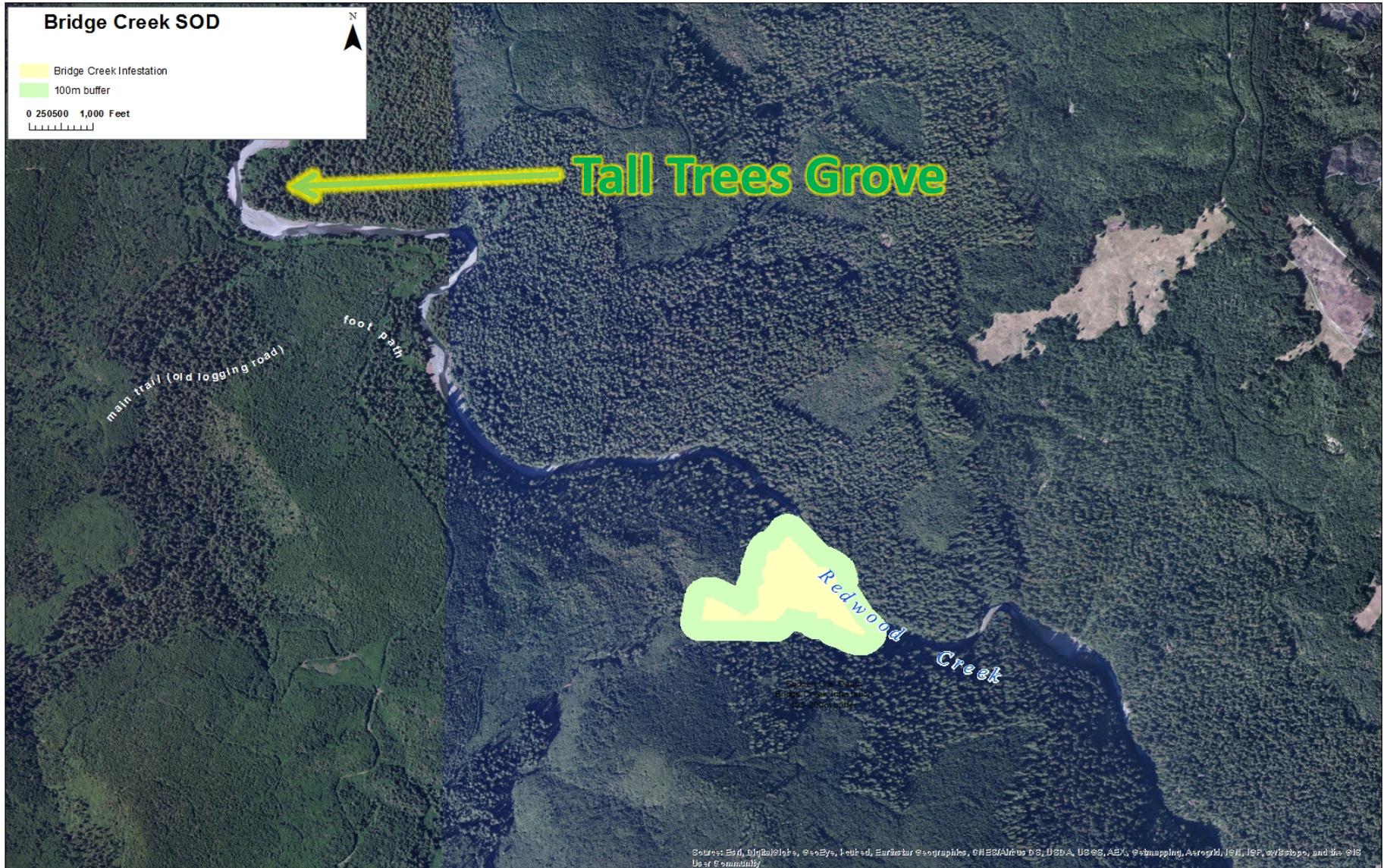


**Bond Creek / 44 Creek
Infestation**

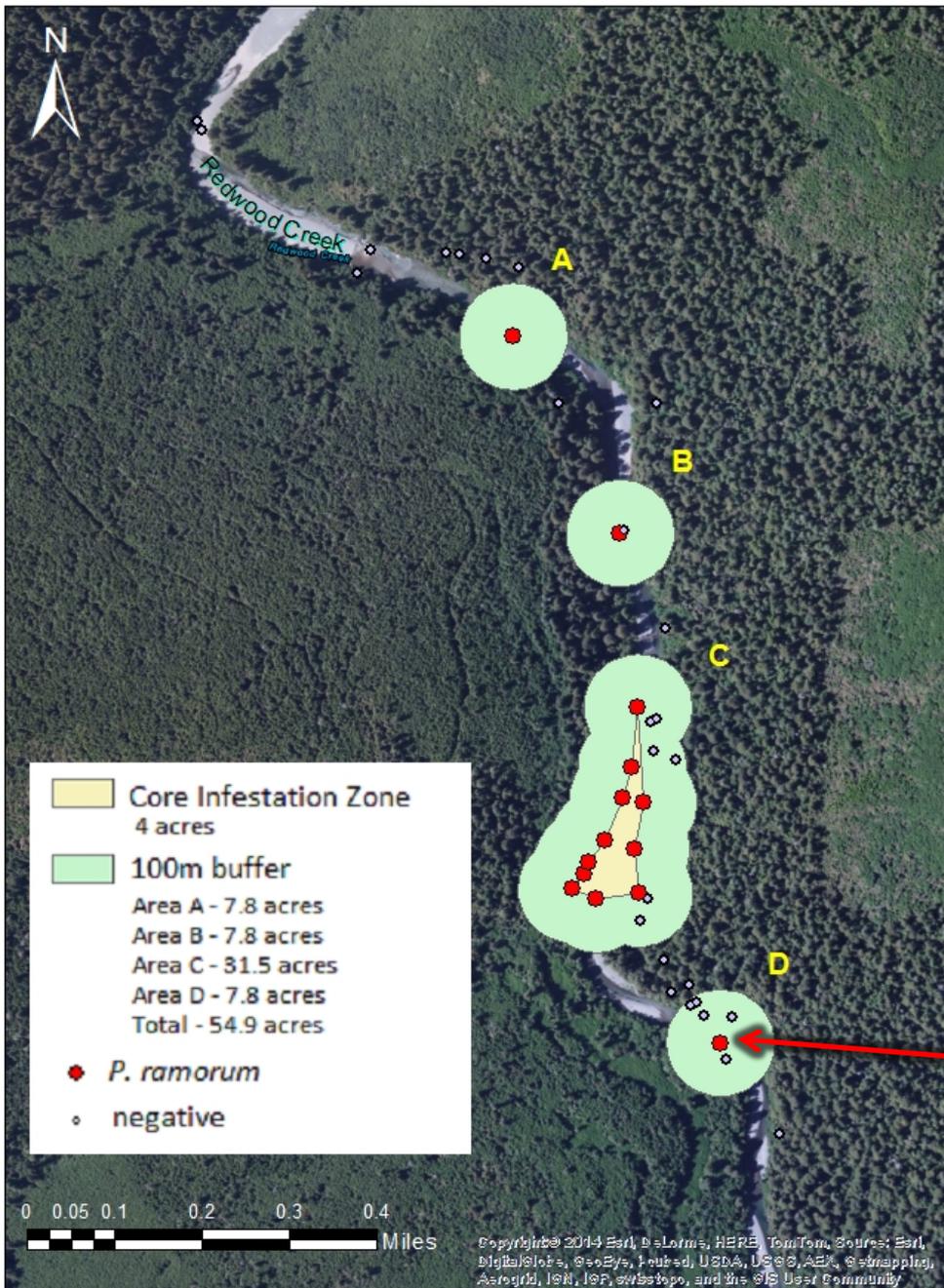
Bridge Creek Infestation

Redwood Nat'l Park: Bridge Creek Infestation

- Tanoak and bay laurel cut already; stump sprouting will be treated in spring



Redwood National Park: Bond Creek - 44 Creek Infestation



- Redwood Creek Trail passes near infection
 - Will be treated in spring 2015

About 2.4 air miles
NW of Bridge Creek
infestation

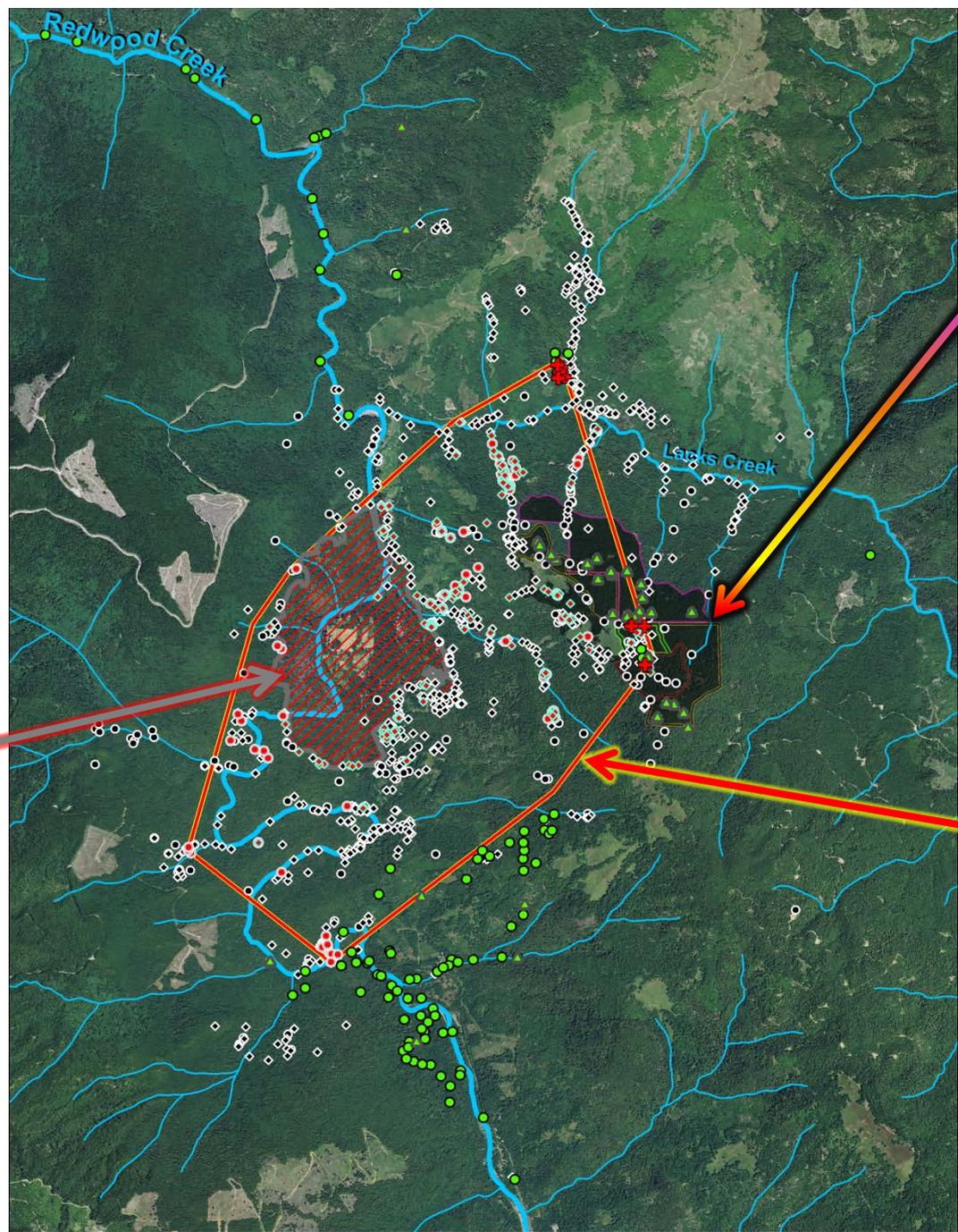


BLACK or **GREEN**
dots =
Negative for
disease

RED dots =
Positive for disease

**Host
removal
zone: 2011
thru 2013
~400 acres**

**Infestation now too
large and concerns
too complicated to
remove all tanoak
and bay laurel**



**Bay laurel
removal and
tanoak thinning
(ahead of
pathogen) and
removal of
infected hosts
where present
~300 acres**

**Perimeter of
infestation
(connect-
the-dots)
~2000 acres**

Thank you RNP. You guys rock.

- Leonel Arguello
- Laura Morgan
- Kayla Conover

...and all of the previous SOD people that were lucky and never saw SOD in RNP