The importance of understory infection by *P. ramorum* as a means of primary disease establishment in Oregon forests

sudden oak death symptoms
Brookings, OR 2011

Ebba Peterson
SOD 5 June 2012

What's going on in the understory?

P. ramorum is recovered from soil.

Goheen et al. 2008

Soil inoculum can initiate infection on understory foliage.

Fichtner et al. 2009

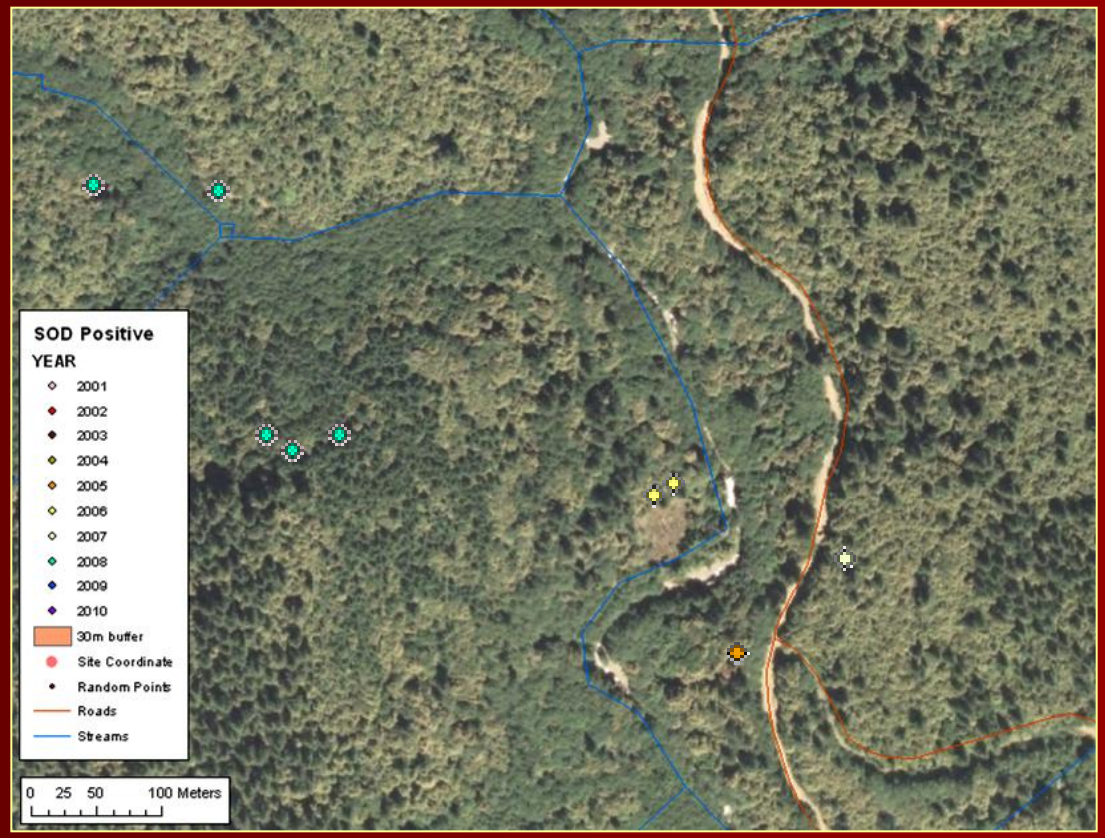
P. ramorum is recovered in all seasons from infested watersheds.

Reeser et al. 2011

Sutton et al. 2009

What's going on in the understory?

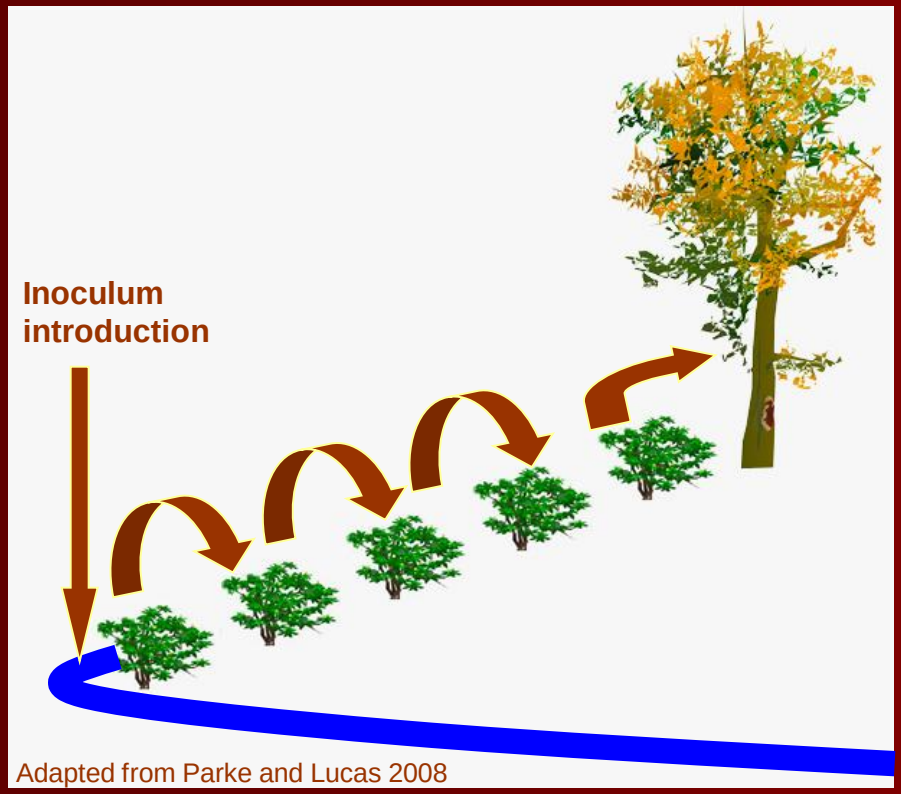
Is aerial detection missing
infection and movement in the understory?



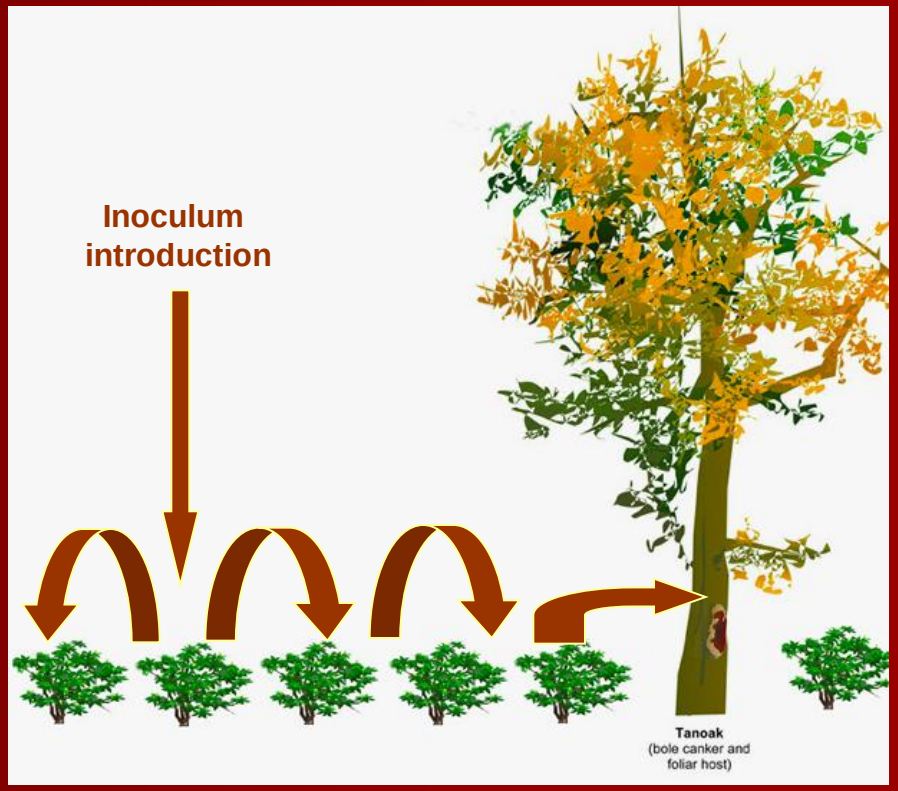
Pathways of Movement

Bottom-up

Consistent with soil / stream → understory → overstory



Adapted from Parke and Lucas 2008

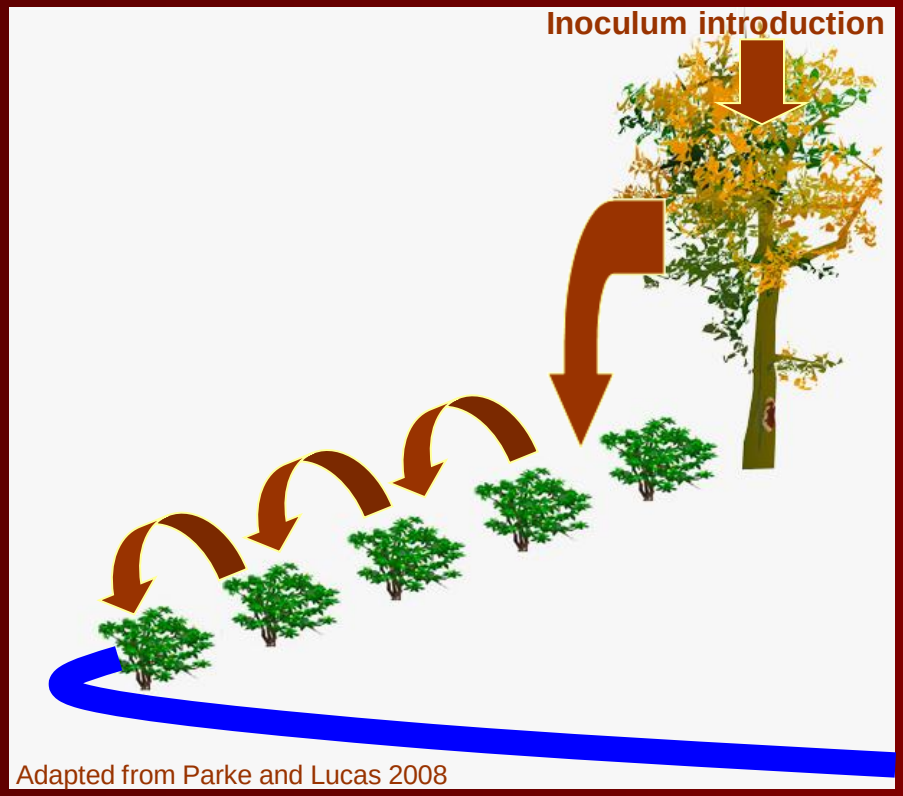


Understory infection closest to the point of introduction *independent* of overstory mortality

Pathways of Movement

Top-down

Consistent with overstory → understory



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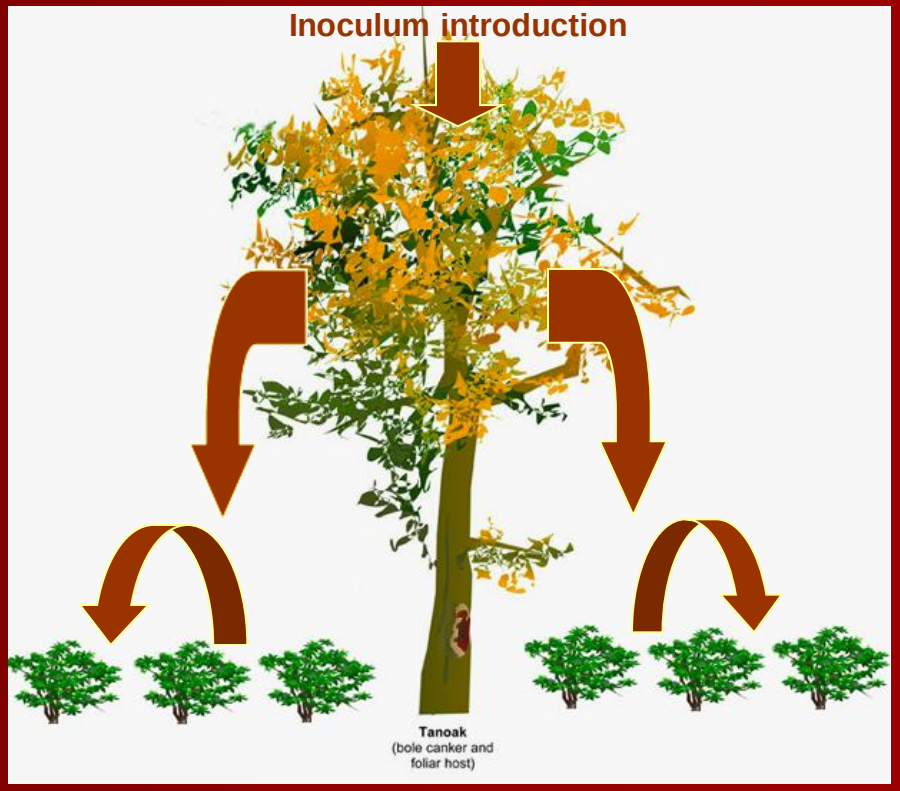
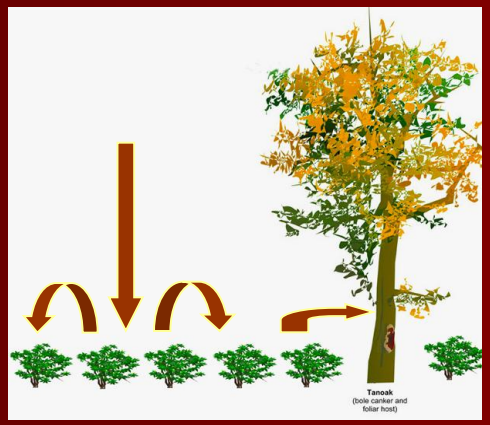
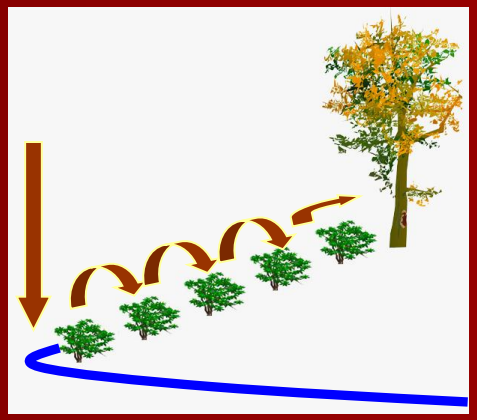
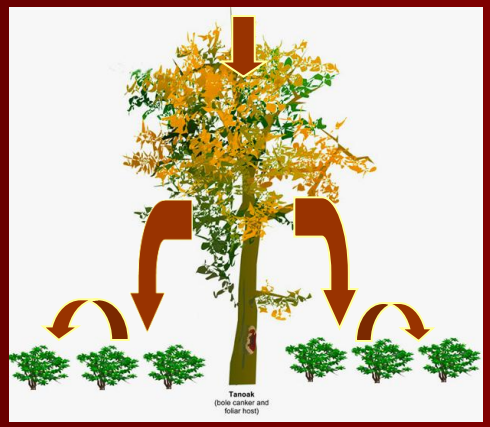
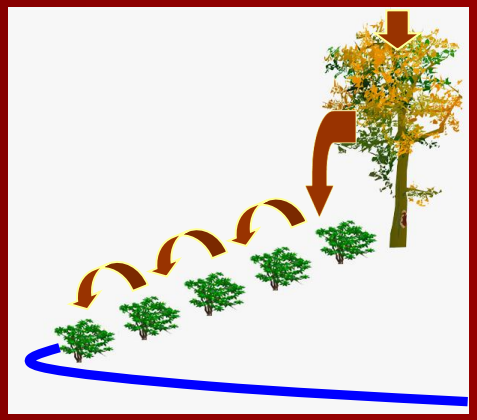


Understory infection closest to the point of introduction

dependent on overstory mortality

Study Question

Does the distribution of understory infection indicate bottom-up or top-down establishment?

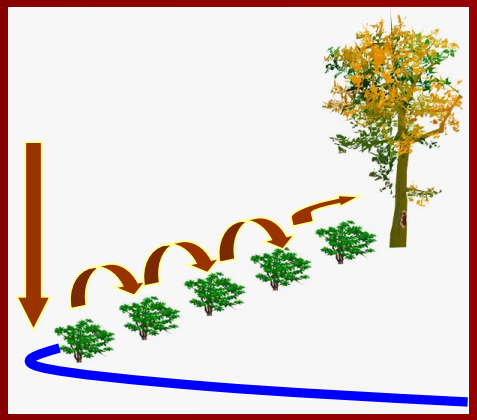
	Local distribution	Stream distribution
Bottom-up (understory)		
Top-down (overstory)		

Study Question

Does the distribution of understory infection indicate bottom-up or top-down establishment?

Local distribution

Stream distribution

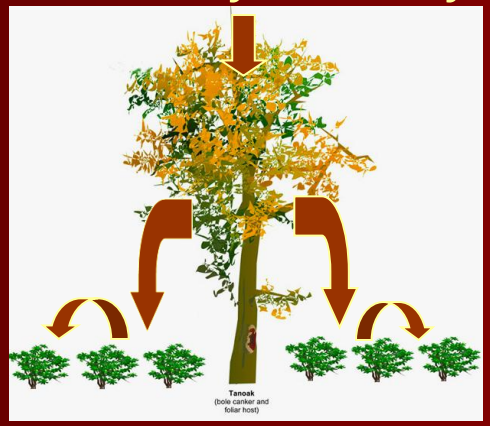


Bottom-up (understory)

Spatial association with overstory mortality

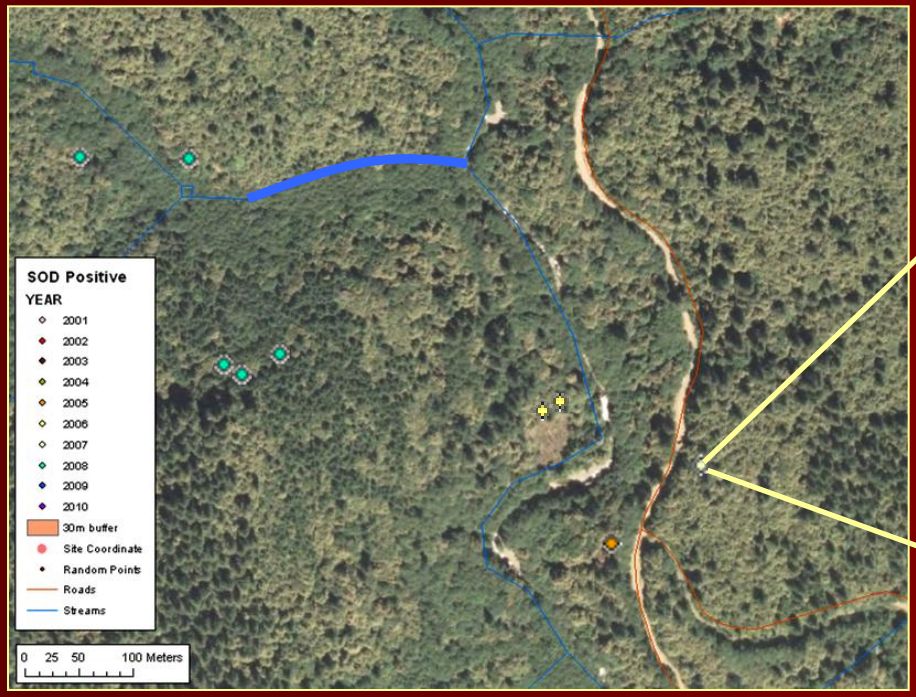
Spatial association with streams

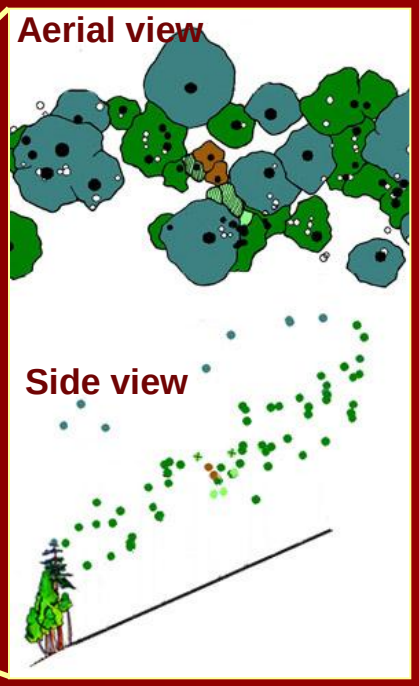
Top-down (overstory)



Methods

Identify sites





Streams lengths

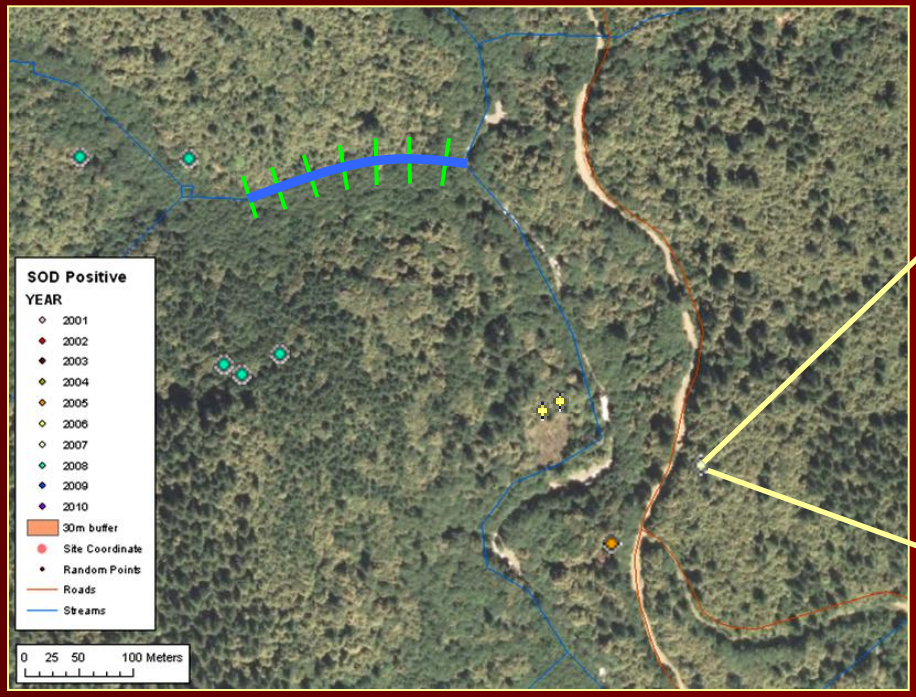
- upstream source / positive bait
- no known overstory mortality

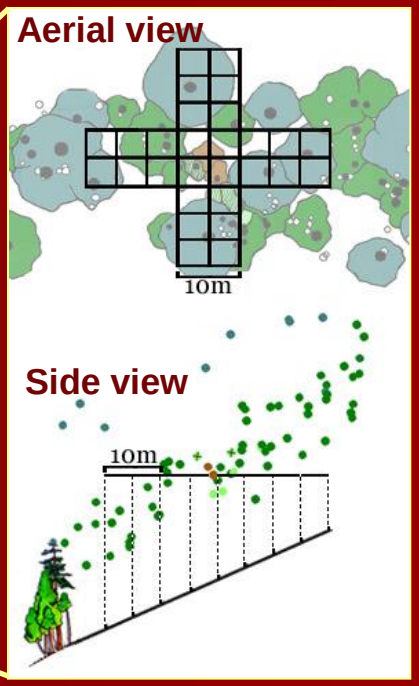
Early-detection sites

- single overstory source

Methods

Sample sites





- Main transects: 200 m
- Side transects: every 10 m

– Host species abundance

– *Phytophthora sp.* in understory CA bay laurel and tanoak

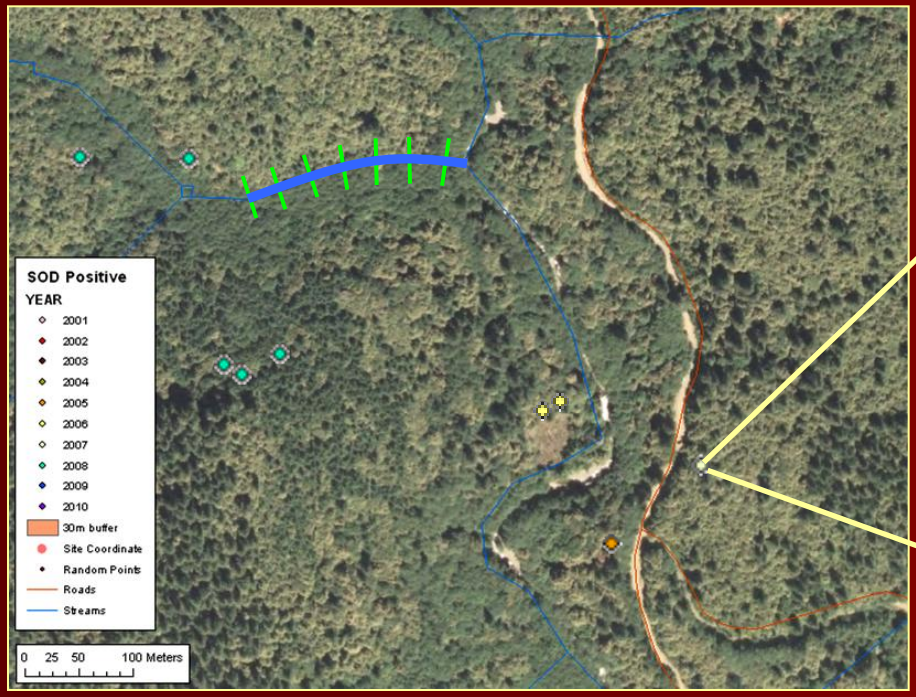
5m^2 grid 20m upslope, downslope, and perpendicular to center

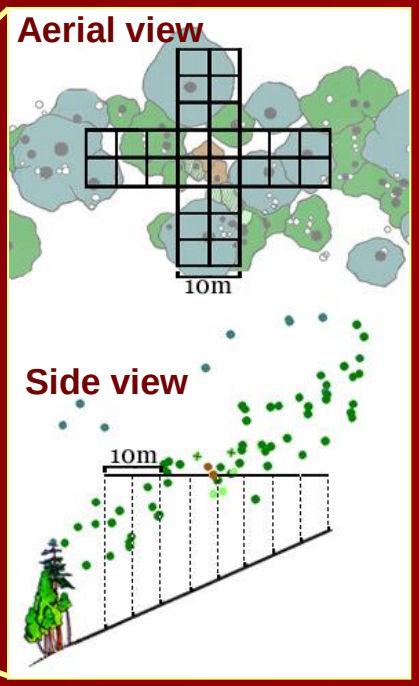
– Host species abundance

– *Phytophthora sp.* in understory rhododendron and tanoak

Methods

Expected results for either pathway





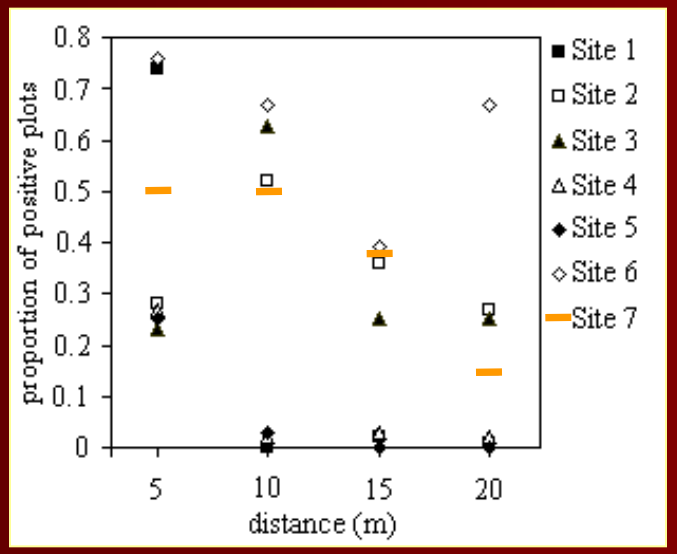
Bottom-up:

expect more understory infection closer to stream

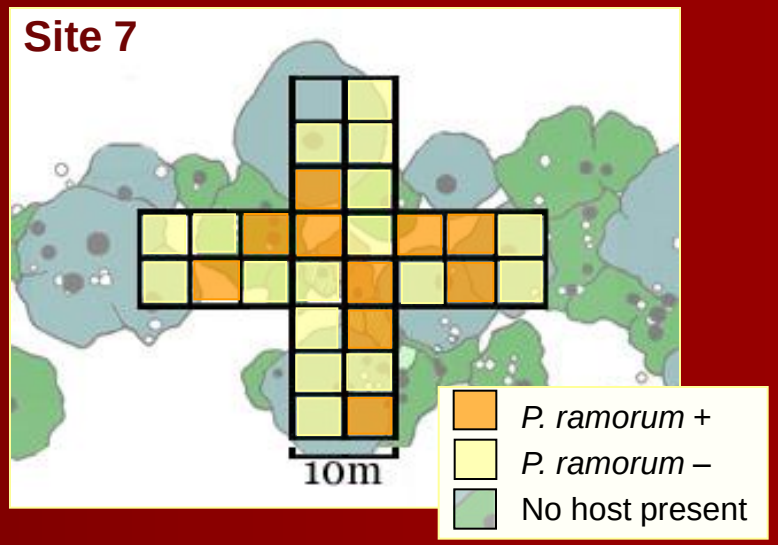
Top-down:

expect more infection at center of the grid.

Results: Local Distribution



Number grids positive / number of grids with a host present (jiggered)



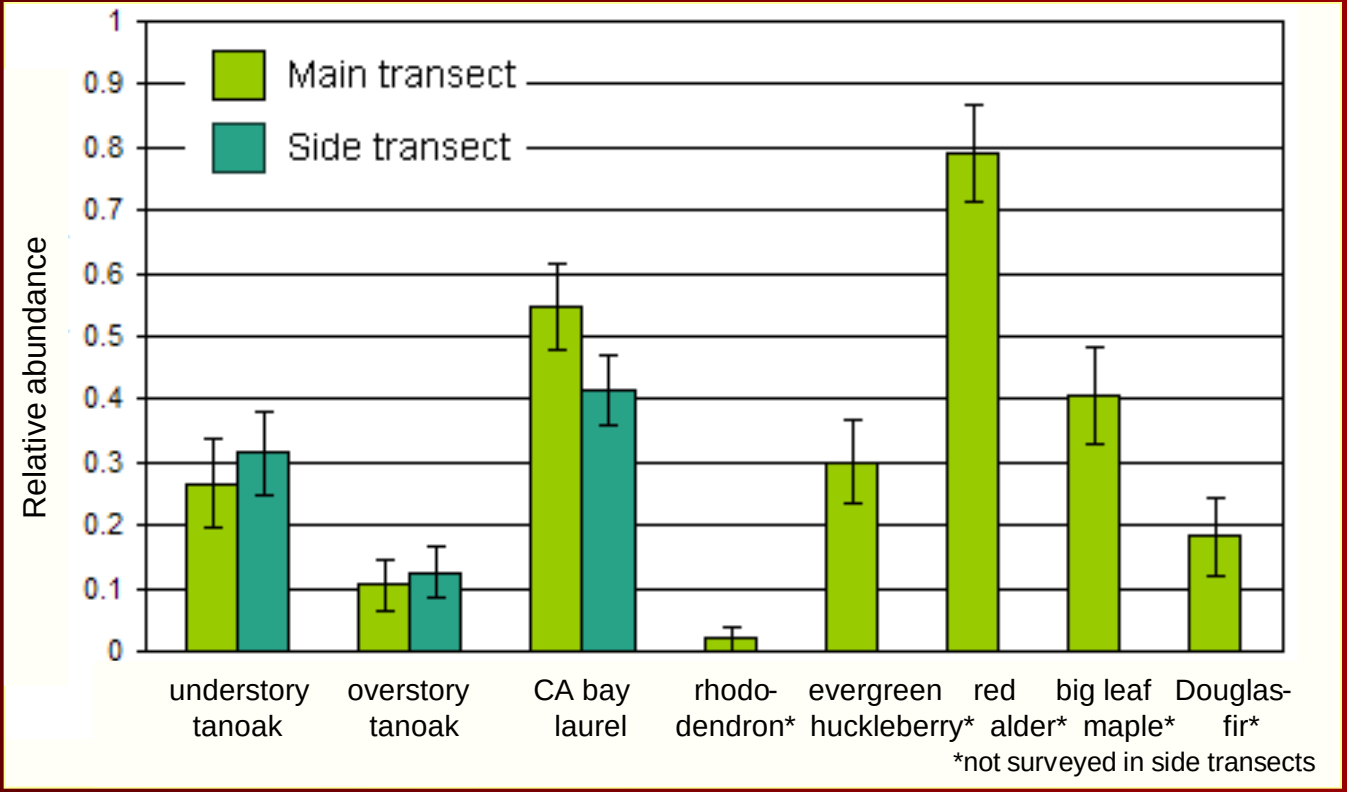
- Significant negative trend between pathogen recovery and distance from the center of each site
  - range of β: -0.0335 to -2.4521

    (Wilcoxon signed-rank test p = 0.0156)

Results: Stream Distribution

Plant Species Abundance

- CA bay laurel is more common in next to streams
  (Wilcoxon signed-rank test p = 0.0090)
- Understory tanoak is equally common
  (Wilcoxon signed-rank test p = 0.7763)

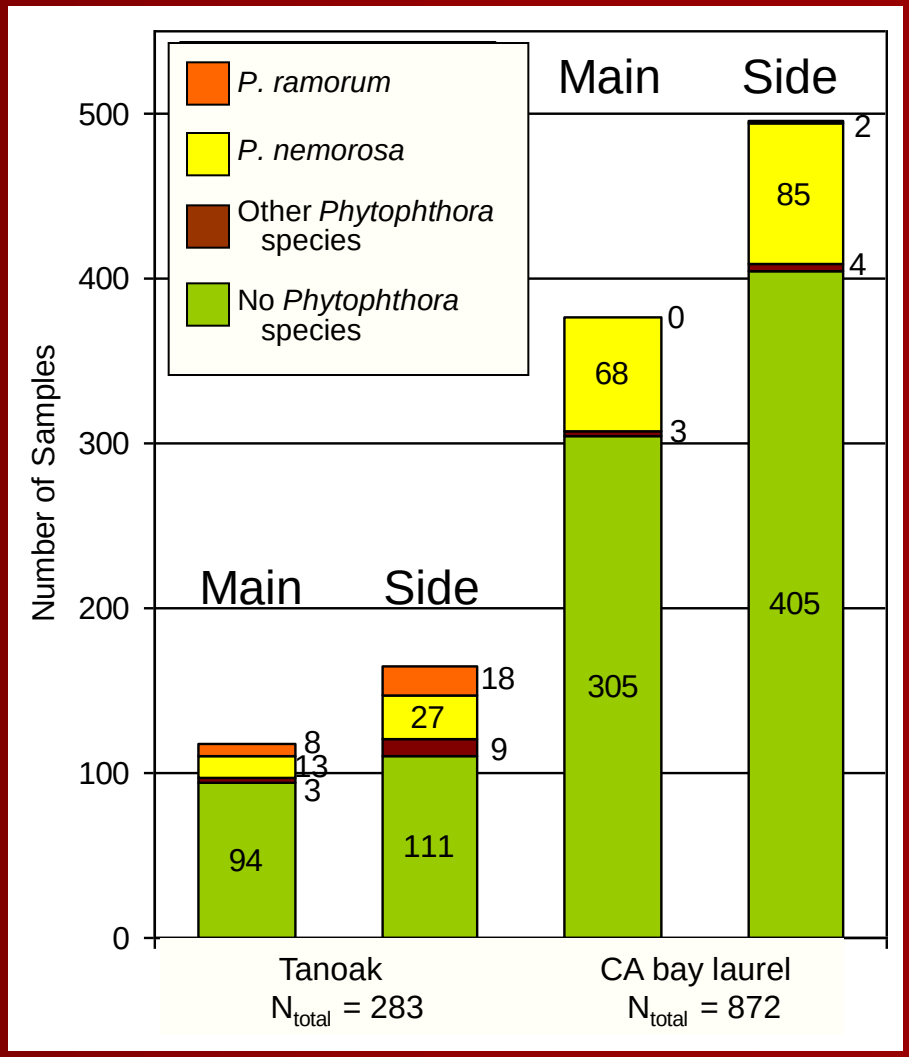


Results: Stream Distribution

Phytophthoras in Understory

- *P. nemorosa* most common
- No preference for:
  - tanoak or bay ($\chi^2 = 1.79$, $p = 0.181$)
  - adjacent or away from streams (26.5% vs. 24.9% recovery in main vs. side, positive streams only)

P. nemorosa

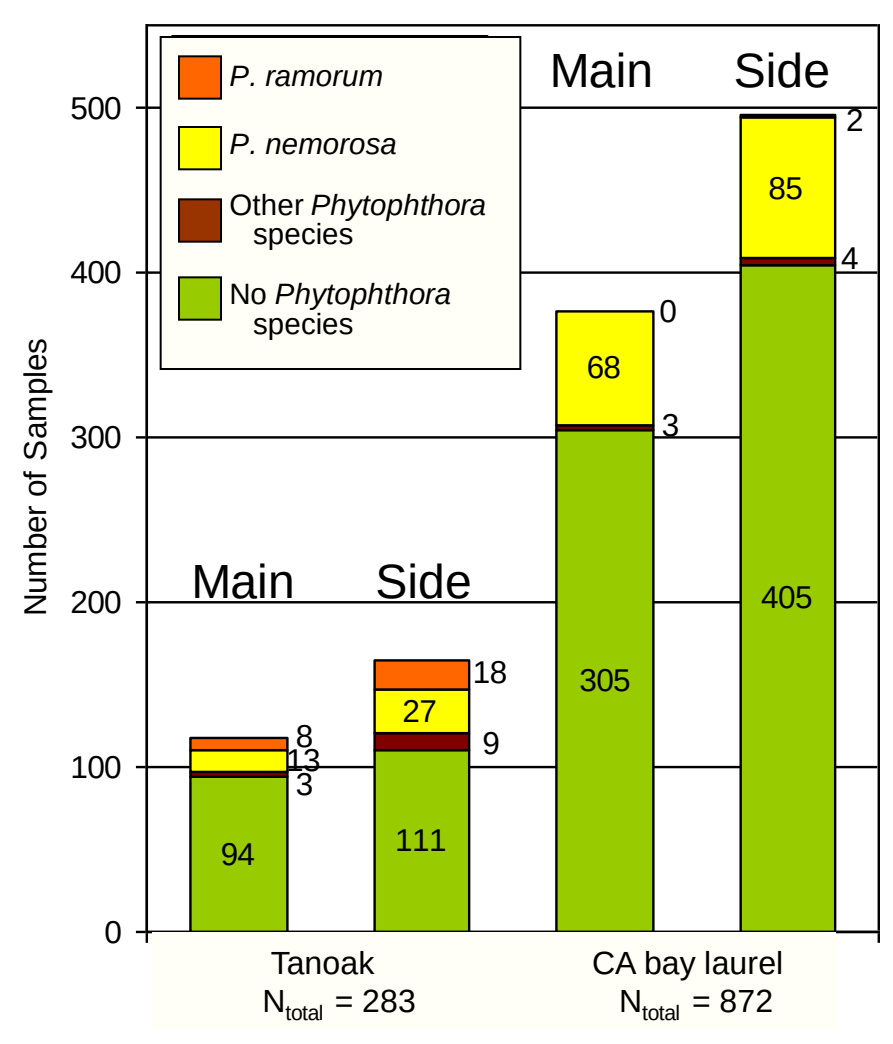


Results: Stream Distribution

Phytophthoras in Understory

- *P. ramorum* in 4 sites
- Preferentially isolated:
  - from tanoak ($\chi^2 = 72.5$, $p < 0.0001$)
  - away from streams (9.38% vs. 34.21% recovery in main vs. side, positive streams only)

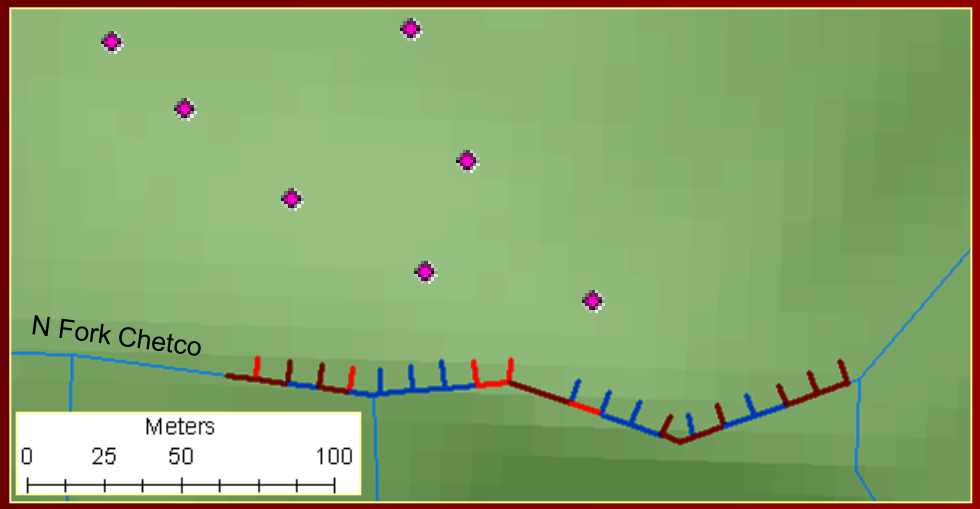
P. ramorum



Results: Stream Distribution

***Phytophthoras* in Understory**

All *P. ramorum* positives have current overstory infection



Surveyed, but no sample taken
Sample *P. ramorum* negative
Sample *P. ramorum* positive
2011 SOD positive

Study Question

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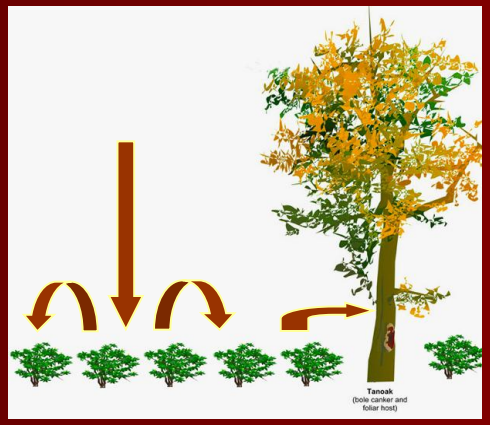
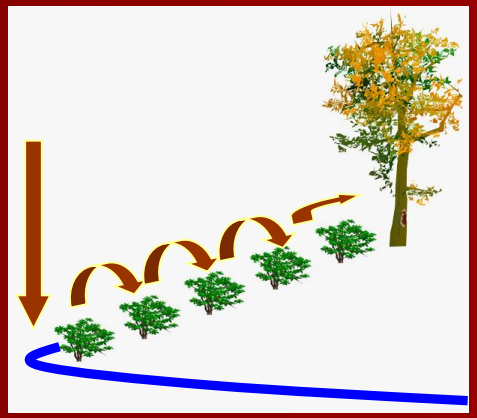
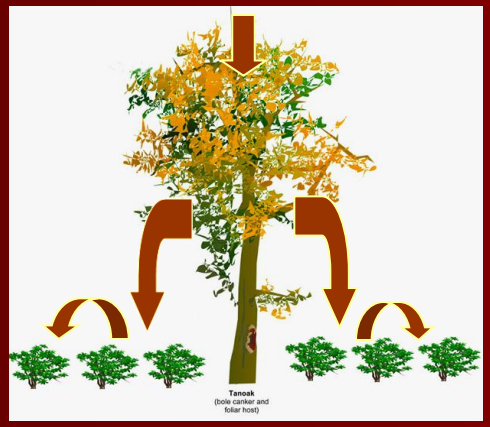
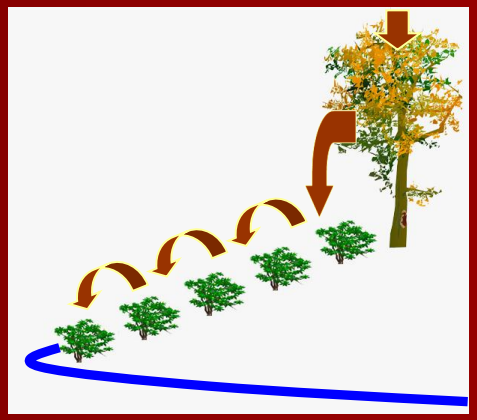
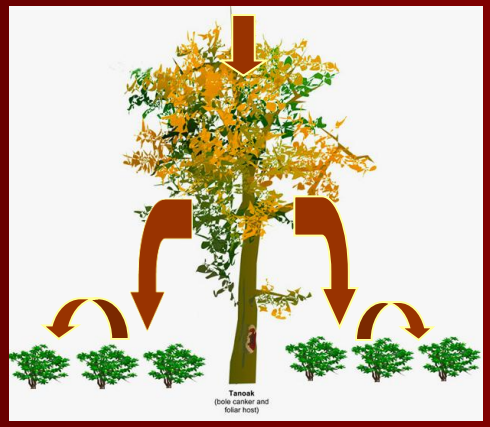
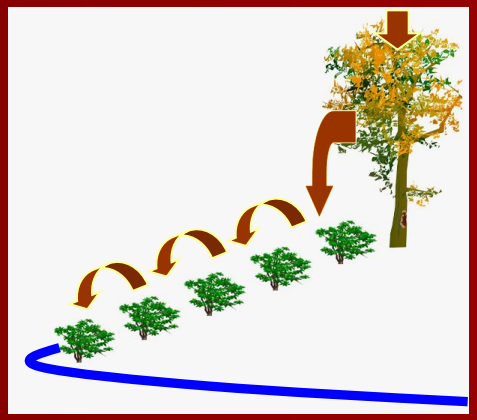
Bottom-up (understory)		
Top-down (overstory)		

Conclusions

- Overstory mortality accurately describes the distribution of *P. ramorum* infection
- Stream-borne inoculum is not resulting in significant stream-side infection
- The distribution of SOD in Oregon represents dispersal capability via non-human aided pathways

Top-down
(overstory)





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