

# Roads Are Not Significant Pathways for SOD Spread, in Oregon At Least<sup>1</sup>

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## Introduction

Control measures for forest Phytophthoras often focus on reducing the spread of infested soils, including closing roads and washing vehicles. Similar measures are suggested for *Phytophthora ramorum*, despite its evident aerial dispersal: stay out of areas of wet soils, and clean clothing and equipment when entering or leaving infested areas. It remains unclear, however, if these measures have limited the spread of *P. ramorum* in Oregon and California.

## Methods

We used two approaches to study the risk of spread of *P. ramorum* along roads in the Oregon quarantine area. First was a spatial analysis of infested sites relative to the road network. Second, was a ground survey for *P. ramorum* along roads in the infested area. For the spatial study, we used GPS coordinates for all *P. ramorum*-positive trees identified between 2001 and 2010 within the North Fork Chetco River study area. Clustered positive trees were reduced in GIS to a single site coordinate defined as the centroid of all trees located within 60 m of one another. GIS road layers were obtained from the POC-GIS regional distribution maps (provided by the U.S. Department of Agriculture Forest Service). Distance from each centroid to the nearest road was calculated with a spatial join relating points (site) to line features (roads).

To test our null hypothesis that sudden oak death (SOD) sites were no closer to roads than expected by chance, random points were generated separately within 1-km wide regions spaced horizontally throughout the study area; the proportion of points created was identical to the proportion of SOD sites found in each region. The distance of each random point to the nearest road was calculated with a spatial join as with the true dataset. Statistical likelihood of observing the true median distance under randomness was computed with a restricted randomization test comparing the observed median distance of SOD sites to roads to 10,000 reiterations of the random dataset.

Road segments were surveyed during the rainy season in 2011 and again in 2012 in a series of transects, on foot. The road segments were in heavily trafficked areas passing through concentrations of SOD sites. Water was collected from mud puddles on the roads and baited for *P. ramorum*. Symptomatic roadside vegetation was also collected and tested for *P. ramorum* infection. A total of 108 puddles and 92 vegetation transects were sampled.

## Results

The spatial analysis showed no association between roads and SOD sites. Some sites were adjacent to roads, but others were far from roads (up to 600 m). The median measured distance from SOD centroids to roads (101 m) was not significantly different (pseudo-p=0.47) from the median distance expected under randomness (fig. 1).

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<sup>1</sup> A version of this paper was presented at the Sudden Oak Death Fifth Science Symposium, June 19-22, 2012, Petaluma, California.

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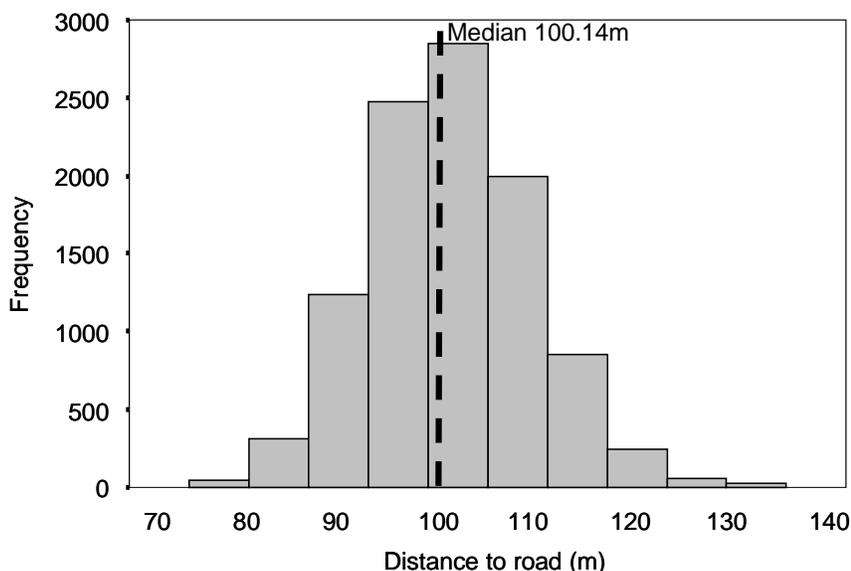


Figure 1—Median measured distance to nearest road (dashed vertical line) compared to median distances generated through a restricted randomization test with 10,000 reiterations of the random dataset (bar graph).

In the 2 years of road sampling, *P. ramorum* was not recovered from road puddles except for single puddles where SOD sites spanned the road (Duley Creek) or run off from an adjacent site (Thousand Line) crossed the road. *Phytophthora ramorum* was isolated from roadside vegetation in seven instances (of 92, 100 m transects) in two areas, but both situations were in an area of general infestation with roadside host plants growing immediately beneath an infected over story tree. *Phytophthora ramorum* was not recovered from puddles or vegetation further along the roads in any case (table 1).

**Table 1—Recovery of *Phytophthora ramorum* from puddles on roads by baiting and from roadside vegetation subject to splash from the roads (100 m transects) by direct isolation**

Site	Puddles		Transects	
	Sampled	<i>P. ramorum</i>	Sampled	<i>P. ramorum</i>
Lewis Creek	10	0	10	0
Thousand Line	42	1	34	0
Duley Creek	10	1	12	5
Mountain View Drive	8	0	4	0
Bean Creek	14	0	8	0
Ostenburg Road	14	0	6	2
Bravo Creek	4	0	8	0
Ransom Ridge	6	0	10	0

Results indicate that roads are not important dispersal pathways for *P. ramorum* in Oregon. This is probably testament to the effectiveness of the sanitation protocols incorporated in the SOD eradication program, as well as evidence of the epidemiological limitations that the harsh road environment forces on *P. ramorum* survival and sporulation.

## Acknowledgments

This work was funded by the USDA Forest Service, PSW Research Station, and PNW Region, Forest Health Protection.