Phytophthora ramorum Detection and Monitoring in Western Washington Waterways, 2010

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Introduction

Phytophthora ramorum, an exotic plant pathogen, is the causal agent of Sudden Oak Death (SOD), ramorum leaf blight, and ramorum dieback. The pathogen can move aerially through landscapes with wind and wind-driven rain, such as in the forests of Oregon and California. In California, hundreds of thousands of tanoak and oak trees have been killed by *P. ramorum* since first detected there in 1995 (Figure 1). The pathogen can also be moved long distances in nursery stock because of it's ability to survive in plant material, soil and water.

Figure 1. *Phytophthora ramorum* caused oak mortality in Big Sur area of California.

Western Washington is at risk for *P. ramorum* caused diseases and *P. ramorum* spread due to the presence of known hosts in the natural environment (Figure 2), suitable climatic conditions (extended periods of moist weather and mild temperatures), and the presence of plant nurseries with positively identified *P. ramorum* infected host stock. To date, the pathogen has only been detected in locations that are either at or near plant nurseries in western Washington.

Figure 2. Example of rhododendron understory found in some western Washington forests. Rhododendron is susceptible to *P. ramorum*.

Survey and Monitoring: 2003 – 2009

The Washington Department of Natural Resources has been conducting aquatic monitoring and forest and nursery perimeter surveys since 2003. Until 2006, *Phytophthora ramorum* had only been detected in western Washington nurseries. In 2006, an aquatic detection site established in a stream running through a *P. ramorum* positive nursery, resulted in positive *P. ramorum* samples from the water. Since 2006, detection and monitoring efforts for *P. ramorum* have primarily focused on water courses associated with nurseries identified as containing *P. ramorum* plant stock. From 2007-2009, *P. ramorum* was detected multiple times in the Sammamish River, King Co., WA using stream baits (Figure 3). However, after the 2009 survey season, it remained unclear where the detected *P. ramorum* inoculum was originating from and whether there were one or multiple entry points of *P. ramorum* inoculum into the Sammamish River.

Figure 3. Each bait bagsis a wire mesh envelope with slots for 4-5 rhododendron leaves (above, left). 2 bait bags are attached with rope, then the set is attached to a weight and placed into the waterway. The traps are left in place for approximately two weeks, then the leaves are collected for processing and new leaves are put into the traps.

Objectives

1) Detect *Phytophthora ramorum* outside of plant nurseries

2) Eradicate *P. ramorum* when detected in landscape and forested ecosystems

3) Reduce the ecological threat that *P. ramorum* could pose on landscape and forested ecosystems in western Washington

Methods

Figure 4. Location of Washington Dept. of Natural Resources 2010 *Phytophthora ramorum* stream baiting traps.

- Sites established in January, 2010 (Figure 4)
- Two *Rhododendron* leaf traps at each site
  - Stillaguamish River, Snohomish Co. , 5 sites
  - Sammamish River, King Co., 14 sites
  - Green River, King Co., 2 sites
- Replicates from Jan. to June (all sites)
  Oct. to Dec. (7 sites in Sammamish)
- Vegetation and soil samples collected
  - *P. ramorum* positive sites
  - upstream from positive sites (Figures 5-7)

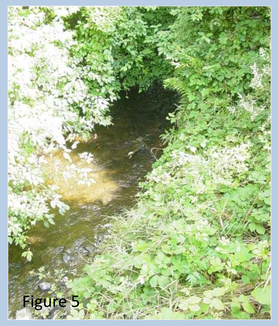

Figure 5

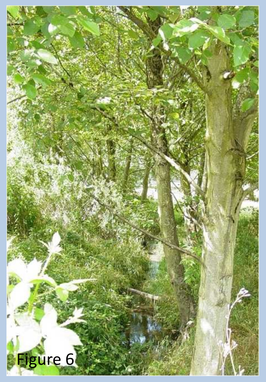

Figure 6

Figure 7

Figures 5-7. Waterway vegetation sampled during the *Phytophthora ramorum* survey. Figure 7 illustrates that the waterway goes underneath the road (notice grey bridge). This is upstream from a positive *P. ramorum* site.

Stream Baiting Results

- *P. ramorum* positive stream baiting sites only in Sammamish River watershed (Figure 8)
  - Seven from Jan. to June baiting period
    Two from Oct. to Dec. baiting period
- 4 positive sites were repeats from 2009
  1 positive site repeat from 2007-2010
- 0 *P. ramorum* positive vegetation or soil samples
- 3 likely entry points of *P. ramorum* inoculum into Sammamish River

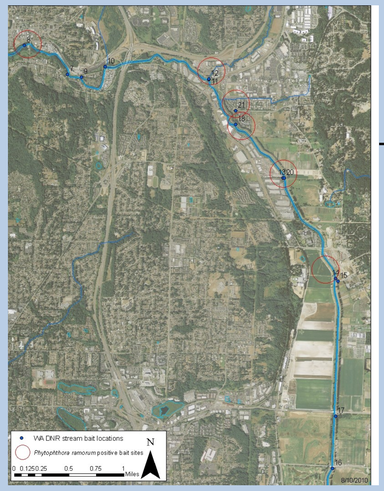

Figure 8. Map of stream bait sites in Sammamish River, King Co., WA . Positive *P. ramorum* sites circled in red. Pictures of positive *P. ramorum* sites below.

→ = direction of waterway flow with *P. ramorum*

★ = location of stream bait traps with *P. ramorum*

Sites 18 & 21

Sites 13 & 20

Site 11

Sites 11 & 12

Discussion

During our 2010 *Phytophthora ramorum* monitoring, seven positive sites were identified. All were associated with the Sammamish River. Four of these sites were also *P. ramorum* positive in 2009. During this years sampling, efforts were made to place a majority of the Sammamish River stream baiting traps in water courses entering into the Sammamish River, yet outside of the influence of the river. These methods facilitated an increased precision of *P. ramorum* inoculum detections entering into the Sammamish River. Three likely points of inoculum entry have been identified in the Sammamish River - at traps 11/12, traps 18/21 and traps 13/20 (see above map). These sets of traps included one near the confluence of the asssociated water course and the Sammamish River and one further upstream in the associated water course.

The originating point of the *P. ramorum* inoculum detected in our survey remains unknown. The area is undergoing rapid development, making it difficult to track watercourses upstream and hindering vegetation surveys along the watercourses. Dr. Gary Chastagner's lab at Washington State University continues to conduct molecular fingerprinting on the positive *P. ramorum* samples in efforts to answer some of the questions associated with *P. ramorum* in the Sammamish River.

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