

Community-based Stream Monitoring for Invasive *Phytophthoras* in Western Washington



Marianne Elliott, Gary Chastagner, Katie Coats, Annie DeBauw, and Kathy Riley
Washington State University, Puyallup Research and Extension Center, 2606 W. Pioneer, Puyallup, Washington 98371

To supplement state agencies in their monitoring for *Phytophthora ramorum*, the exotic sudden oak death (SOD) pathogen, a community-based stream monitoring program was initiated in 2010. This project expands on the streams currently being sampled by the Washington Department of Natural Resources (WADNR) as part of the national *P. ramorum* survey and on nursery surveys by Washington State Department of Agriculture (WSDA) and allows for early detection of *P. ramorum* and other invasive *Phytophthora* species, as well as examining the biodiversity of *Phytophthora* spp. in stream ecosystems. This project provided an opportunity to increase public awareness of waterborne plant pathogens and the damage they can cause.

No *P. ramorum* was found in any of the streams in 2010, even those downstream from previously positive nursery sites. The most commonly found species in all the streams was *P. gonapodyides*. This species is ubiquitous, but not much is known about its biology.

Volunteers included Master Gardeners, high school, community college, and University of Washington Tacoma students, and others. Lecture and lab sessions were taught as part of the college classes to introduce students to plant pathology, *Phytophthora* diseases, and laboratory methods. Some students from the college classes worked on group projects related to *Phytophthora* in the lab at WSU-Puyallup. The program is being expanded in 2011 with more baiting sites and student involvement.



Our Baiting Method

1. *Rhododendron* leaves are inserted into mesh bags and placed in target stream for two weeks.
2. Leaves are plated onto *Phytophthora*-selective media (PARP-H V8).
3. *Phytophthora* colonies are transferred onto V8 agar.
4. *Phytophthora* species are identified by sequencing of the rDNA ITS region.



Western Washington Monitoring Sites

Site #	County	Creek	Type	Volunteers
2010 Monitoring Sites				
1001	Pierce	Clarks	Nursery	Puyallup High School
1002	Whatcom	Anderson	Nursery	Volunteer
1003	King	Evans	Suburban/rural	Master Gardeners
1004	Pierce	First	Urban	UW Tacoma
1005	Pierce	Puget	Under restoration	UW Tacoma
1006	Kitsap	Dogfish	Nursery	Master Gardeners
1007	Pierce	Clarks	Headwaters	Pierce College
2011 Monitoring Sites				
1101	Clark	Packard	Nursery	Master Gardeners
1102	Pierce	Clarks	Nursery	Puyallup High School
1103	Pierce	Clarks	Headwaters	Puyallup High School
1104	Thurston	Woodard	Nursery	Volunteer
1105	Mason	Goldsborough	Trace-forward	Master Gardeners
1106	Snohomish	North	New development	Master Gardeners
1107	Kitsap	Clear	New development	Master Gardeners
1108	King	Peters	New development	Master Gardeners
1109	Mason	Vance	Undisturbed	Master Gardeners
1110	Pierce	Thea Foss	Degraded saltwater	Bellarmine High School
1112	Pierce	Wollochet	Nursery	Peninsula High School
1113	Pierce	Rosedale	Nursery	Peninsula High School



Student Projects for 2010

"The Shoe Experiment"

Testing various disinfectants for sanitizing the bottoms of shoes.

Students from Pierce College, Puyallup, investigated whether some commonly used disinfectants are able to kill *P. ramorum* inoculum transported on shoes. It is a common practice to spray shoe soles with a disinfectant when leaving a *P. ramorum*-positive nursery or lab where *P. ramorum* is studied, but there has been little research showing which disinfectants are effective in reducing inoculum.

In this study, three types of shoe material and six treatments were tested. Three of the treatments were effective in destroying *P. ramorum* inoculum; however this was decreased in the presence of soil. Therefore, removing soil from shoes before spraying with disinfectants is recommended.



What People Thought

"I believe this project was a fantastic learning experience. I certainly will take a lot with me and I was happy to contribute to WSU's research. Even though we didn't find *Phytophthora ramorum* in First or Puget Creek (which is great news!), I believe that this project should continue to be done in further classes because it is really interesting and is quite important to us living here in the Pacific Northwest."

"Working with the researchers at WSU Puyallup was a great experience for us. Learning in a classroom is much different than actually working with people who do this for a living. They were able to teach us things that we may have not capable of learning in the classroom."

"I would recommend this project being done again for the next class. It was a great learning experience. To be able to learn about something that is testable in our local environment is very educational and eye opening. There are not many classes where you can do this kind of experiment in the local area."

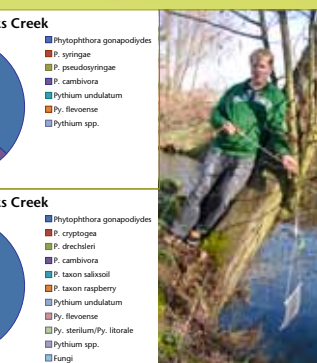
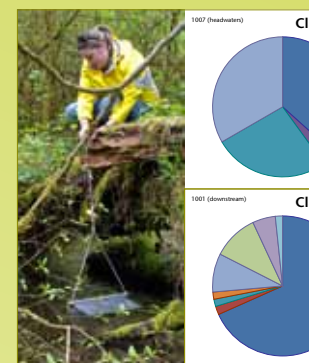
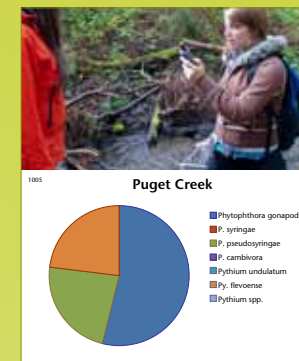
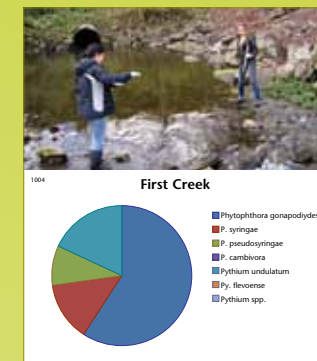
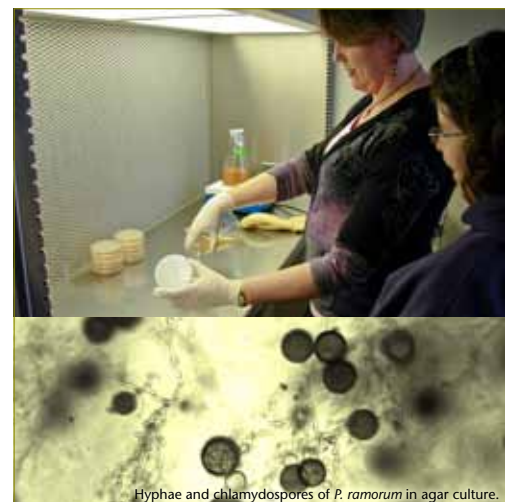
"I thought it was fantastic to collaborate with the researchers at WSU Puyallup because it made me feel like everyone was working together. The reality is that if we want to do good by our environment, we need the brightest minds working together, sharing their findings and sharing the best methods for detection to ensure the work being done is truly worthwhile."

Tolerance of *P. ramorum* for saline conditions

Several species of *Phytophthora* can survive and sporulate in saline environments, but it is not known whether *P. ramorum* is able to tolerate such conditions. Students from University of Washington, Tacoma, examined the effects of seawater on *P. ramorum* mycelial growth and sporulation.

Mycelial growth was partially inhibited with increasing salinity. However, chlamyospore production on rhododendron leaf discs tended to increase, especially in the NA2 lineage.

Furthermore, since *P. ramorum* can survive in saline conditions, the students concluded that the movement of *P. ramorum* infested plant material on barges or in holds of ships may present another possible means of introduction of this exotic pathogen to new areas.



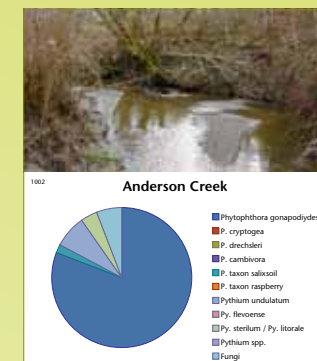
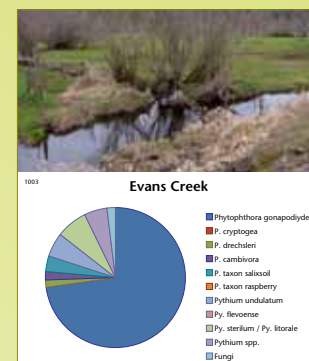
2010 Results

Three urban streams were monitored in 2010. The *Phytophthora* and *Pythium* populations varied a great deal among the streams, reflecting the differences in land use and inputs to the streams at each site.

Dogfish Creek in Kitsap County is relatively undisturbed. First Creek and Puget Creek in Tacoma (Pierce County) are both under restoration, though First Creek is more degraded (having been used as a dump site previously). Puget Creek is a salmon-bearing stream.

One site near the headwaters of Clarks Creek in Puyallup and one site downstream from all tributaries were monitored in 2010 (middle row) and in 2011.

Two streams in rural areas in King County (Evans Creek) and Whatcom County (Anderson Creek) were monitored in 2010. The land use in these areas is primarily small farms.



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