

# Soilborne *Phytophthora* spp. at Restoration Sites in the Midpeninsula Regional Open Space District

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The inadvertent spread of *Phytophthora* species from nurseries into native ecosystems has increased interest in assessing *Phytophthora* diversity in native plant communities. Of major concern is the inadvertent movement of *Phytophthora* spp. from native plant nurseries into vulnerable habitats during restoration outplantings. Root-infecting *Phytophthora* spp. are abundant within plant nurseries; their introduction can result in failed plantings, reduced natural regeneration, and further spread of *Phytophthora* into surrounding habitat. To assess this risk we surveyed restoration sites within the Midpeninsula Regional Open Space District (MROSD) to determine the presence and distribution of *Phytophthora* pathogens.

In December 2017 we collected soil from the base of symptomatic plants at 20 planted-restoration sites, 7 planned-restoration sites, and 18 non-planted, minimally disturbed areas adjacent to the restoration projects. Soil baits yielded *Phytophthora* species from 10 planted-restoration sites, 2 planned-restoration sites, and 8 non-planted, minimally disturbed sites. Species of concern include *P. ramorum*, *P. cinnamomi*, *P. cambivora* and *P. cactorum*, all of which are associated with plant decline in native plant communities.

To identify any additional oomycete species that might be present, we extracted DNA from 10 g of each soil sample. The ITS1 region was amplified and sequenced with the high-throughput Illumina MiSeq platform. *Phytophthora* was equally prevalent in planted and non-planted areas, however many species were only found in areas in which nursery plants were introduced. This method also detected numerous species not recovered by baiting, including *P. quercina* and *P. tentaculata*.

*Phytophthora* spp. are widespread within MROSD preserves, although some preserves had noticeably greater species diversity and detection frequency. Given the complex history of disturbance at restoration sites we cannot always conclusively determine which *Phytophthora* spp. were introduced via nursery-grown plants. Nevertheless, future management of MROSD preserves and restoration projects should utilize best management practices to limit the spread of *Phytophthora* to surrounding environs.