

# A Survey of *Phytophthora* and *Pythium* spp. in Soil from Upland Prairie Restoration Sites in Western Oregon

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Native upland prairie and oak savanna habitats were once widespread in the Willamette Valley of western Oregon, but have been diminished by conversion to other land uses. These threatened habitats are considered essential for rare and endangered species such as the Fender's blue butterfly (*Icaricia icarioides fenderi*). Restoring native upland prairie habitats is a major goal of wildland restoration in Oregon.

The inadvertent spread of *Phytophthora* species from nurseries into native ecosystems can have long-term environmental and economic impacts, as has been seen with *Phytophthora ramorum*, *P. lateralis*, *P. cinnamomi*, *P. tentaculata*, and other species. The risk may be particularly great when nursery-grown plants infested with *Phytophthora* spp. are planted in restoration sites, introducing pathogens directly into native habitats.

The objective of this study was to estimate the prevalence and species composition of *Phytophthora* and *Pythium* in upland prairie restoration sites in western Oregon. We tested soil from 55 upland prairie/oak savanna sites using two methods: baiting and next generation sequencing. Soils were baited with pears; pure cultures from bait lesions were Sanger sequenced for species identification based on the ITS region. In addition, DNA was extracted from each soil sample, amplified with PCR, sequenced with the Illumina MiSeq platform, and analyzed to assess microbial communities (*Phytophthora* and *Pythium*, fungi, and bacteria). Only the findings of *Phytophthora* and *Pythium* spp. will be reported here.

*Pythium* species were nearly ubiquitous, detected in 46 of the 55 sites. *Pythium attrantheridium*, reported to be an indigenous plant pathogen, was the most abundant species. Other species included the *Py. glomeratum-complex*, *macrosporum*, *ornacarpum-complex*, *pachycaule-complex*, *paroecadrum*, *parvum*, *pectinolyticum*, *ultimum*, *mamillatum-complex*, *terrestris-complex* and *volutum*. *Phytophthora* species were detected, but in only 7 of 55 sites, and included *P. cambivora*, *megasperma*, *fragariae-complex*, *cactorum-complex* and an unknown species. There was no clear association between planting history or management practices and the presence of *Phytophthora* or *Pythium* species. Results of this study provide a snapshot of the current distribution of *Phytophthora* and *Pythium* species in restoration sites in western Oregon and can serve as a baseline for recognizing future introductions.