

Introduction

Plant Restoration and conservation are important processes when it comes to protecting the planet's biodiversity. Many setbacks can arise during procedures. One of these problematic issues at the California Botanic Garden Nursery is caused by a plant pathogen called *Phytophthora*. Species within this genus are responsible for diseases like sudden oak death and potato late blight (Oregon State University, 2021). *Phytophthora* was first discovered in 1846 by Miles Joseph Berkeley (Birch, 2013). This pathogen spreads from plant to plant through water, using its zoospores to swim to the new host plant. According to the Restoration Project Manager at the nursery, Billy Sale, many of its species infect plant roots causing root rot but can also cause foliar infection. The purpose of this research is to find out the adverse effects of *Phytophthora* at the California Botanic Nursery.

Methods

- Analyzed and averaged yearly costs
- Analyzed average amount of time spent completing required sanitation procedures
- Conducted *Phytophthora* testing and compared it with previous tests to obtain the approximate amount of time needed for testing

Results

- The nursery spends approximately \$2,123 annually on material used to help stop and prevent the spread of *Phytophthora*.
- It takes approximately 145.19 hours per year to sanitize all equipment, floors and other parts of the nursery
- Each *Phytophthora* test takes about an hour to conduct. Except during the summers where it could take an additional 30-45 minutes due to increased water temperatures. Water temperature needs to stay at or below 77 degrees Fahrenheit



Figure 1. Picture of Tanoak mortality in Humboldt County in 2006 caused by *P. ramorum* (California Oak Mortality Task Force).



Figure 2. Picture of the soil wagon and steamer at the nursery, sanitizing soil.



Figure 3. Picture of the *Phytophthora* testing site at the nursery.



Figure 4. Picture of plants used during the testing, Thermometer being used to check plant soil temperature.



Figure 5. Picture of pear sitting in the water drained from nursery plants after completing *Phytophthora* testing

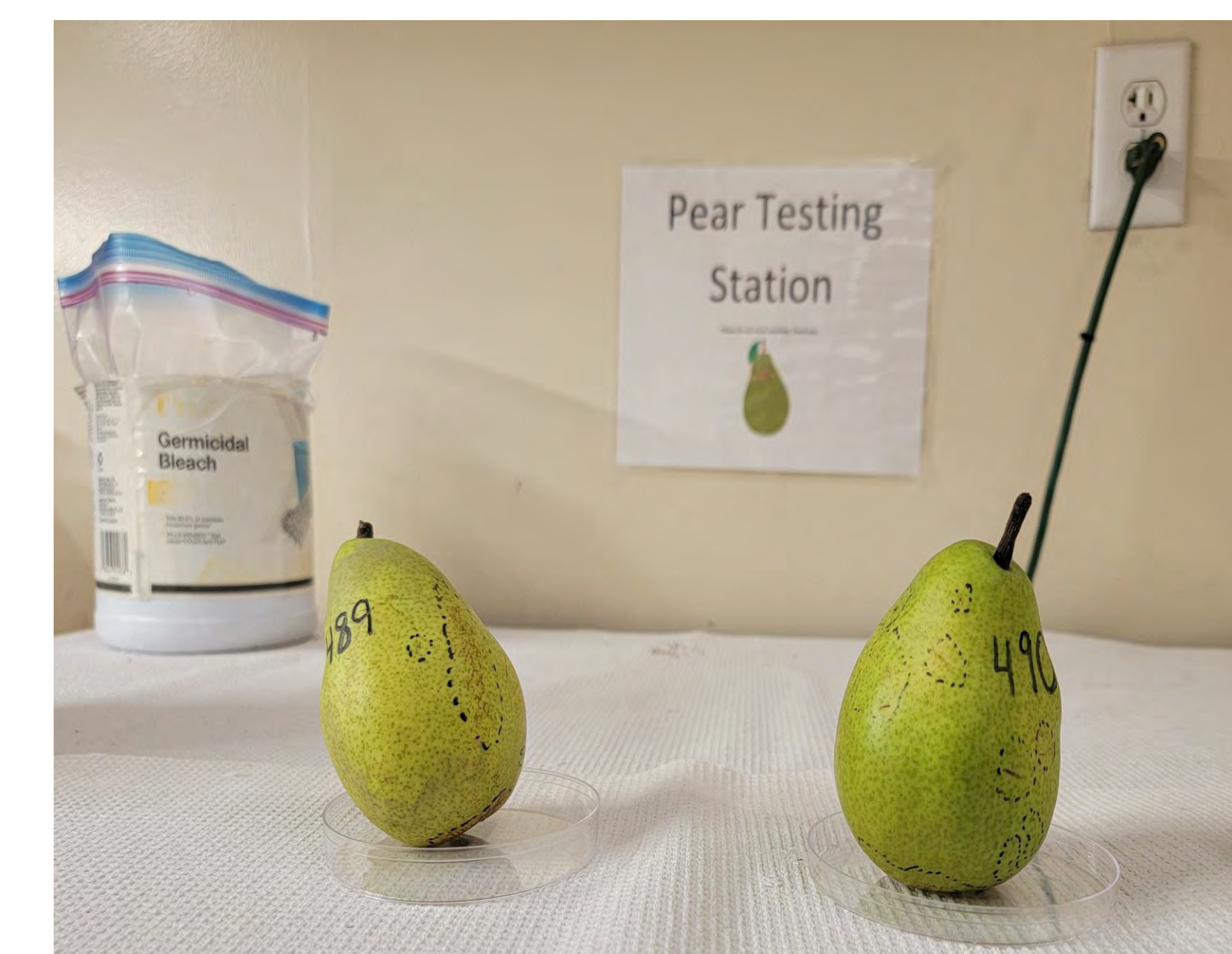


Figure 6. Picture of the two pears approximately 72 hours after testing. These tested negative for *Phytophthora*.

Summary

The research conducted at this nursery shows how *Phytophthora* can adversely affect restoration and conservation efforts if it is not regulated. This pathogen has accidentally been introduced into high-value and limited habitats in restoration plantings conducted around the state of California (Frankel et al. 2020). Once this exotic and invasive disease establishes itself it degrades the environment which the plantings were supposed to enhance (Frankel et al. 2020). Locations like the California Botanic Garden Nursery have taken the initiative to conduct tests on plants intended for restoration and have extensive Phytosanitation regulations which help prevent the spread of this pathogen.

Possible Sources of Error

- Variability of time used to conduct tests and complete sanitation procedures
- Irregularity of product prices

References

- Birch P. R., & Cooke D. E. (2013, June 18). *The early days of late blight*. eLife. Accessed August 10, 2022, from doi: 10.7554/eLife.00954. PMID: 23795302; PMCID: PMC3687336.
- Frankel, S. J., Alexander, J., Benner, D., Hillman J., &Shor, A. (2020). *Phytophthora* pathogens threaten rare habitats and conservation plantings. *Sibbaldia: The international Journal of Botanic Garden Horticulture*. Accessed August 16, 2022, from <https://srs.fs.usda.gov/pubs/59623>
- Oregon State University. (2021, July 22). *What is phytophthora?* College of Agricultural Sciences. Accessed August 10, 2022, from <https://horticulture.oregonstate.edu/nursery/nursery/what-phytophthora>

Acknowledgments

I would like to thank Citrus College, Pathways to STEM and California Botanic Garden for giving me this amazing learning experience. I also want to thank Billy Sale and Alejandra Soto for their help and guidance on this project.

Alternate Text:

Gabriela Avalos

Citrus College, Pathways to STEM, California Botanic Garden. *'What are the Negative Effects of Phytophthora at California Botanic Garden Nursery'*

Introduction: Plant Restoration and conservation are important processes when it comes to protecting the planets biodiversity. Many setbacks can arise during procedures. One of these problematic issues at the California Botanic Garden Nursery is caused by a plant pathogen called Phytophthora. Species within this genus are responsible for diseases like sudden oak death and potato late blight (Oregon State University, 2021). Phytophthora was first discovered in 1846 by Miles Joseph Berkeley (Birch, 2013). This pathogen spreads from plant to plant through water, using its zoospores to swim to the new host plant. According to the Restoration Project Manager at the nursery, Billy Sale, many of its species infect plant roots causing root rot but can also cause foliar infection. The purpose of this research is to find out the adverse effects of Phytophthora at the California Botanic Nursery.

Methods: Analyzed and averaged yearly costs. Analyzed average amount of time spent completing required sanitation procedures. Conducted Phytophthora testing and compared it with previous tests to obtain the approximate amount of time needed for testing.

Figure 1. Picture of Tanoak mortality in Humboldt county in 2006 caused by P ramorum. (California Oak Morality Task Force)

Figure 2. Picture of the soil wagon and steamer at the nursery, sanitizing soil.

Figure 3. Picture of the Phytophthora testing site at the nursery.

Figure 4. Picture of plants used during the testing, Thermometer being used to check plant soil temperature.

Figure 5. Picture of pear sitting in the water drained from nursery plants after completing Phytophthora testing.

Figure 6. Picture of the two pears approximately 72 hours after testing. These tested negative for Phytophthora.

Summary: The research conducted at this nursery shows how phytophthora can adversely affect restoration and conservation efforts if it is not regulated. This pathogen has accidentally been introduced into high value and limited habitats in restoration plantings conducted around the state of California (Frankel et al. 2020). Once this exotic and invasive disease establishes itself it degrades the environment which the plantings were supposed to advance (Frankel et al. 2020). Locations like the California Botanic Garden Nursery have taken the initiative to conduct tests on plants intended for restoration and have extensive Phyto-sanitation regulations which help prevent the spread of this pathogen. *Possible Sources of Error-* Variability of time used to conduct tests and complete sanitation procedures. Irregularity of product price.

References: Birch P. R., & Cooke D. E. (2013, June 18). The early days of late blight. eLife. Accessed August 10, 2022, from doi: 10.7554/eLife.00954. PMID: 23795302; PMCID: PMC3687336. Frankel, S. J., Alexander, J., Benner, D., Hillman J., &Shor, A. (2020). Phytophthora pathogens threaten rare habitats

and conservation plantings. *Sibbaldia*: The international Journal of Botanic Garden Horticulture. Accessed August 16, 2022, from <https://srs.fs.usda.gov/pubs/59623>. Oregon State University. (2021, July 22). What is phytophthora? College of Agricultural Sciences. Accessed August 10, 2022, from <https://horticulture.oregonstate.edu/nursery/nursery/whatphytophthora>.

Acknowledgements: I would like to thank Citrus College, Pathways to STEM and California Botanic Garden for giving me this amazing learning experience. I also want to thank Billy Sale and Alejandra Soto for their help and guidance on this project.