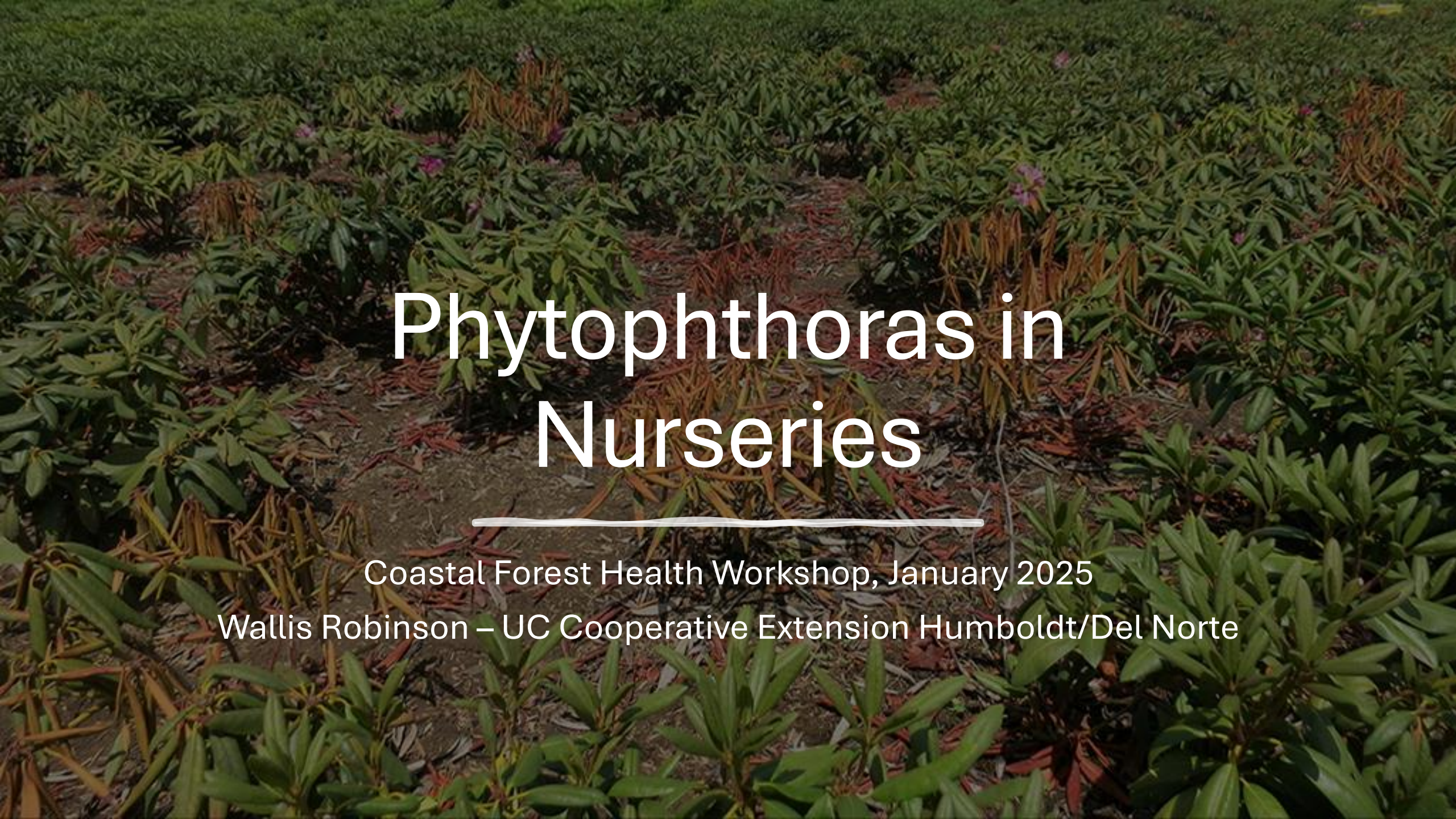


Phytophthoras in Nurseries

Coastal Forest Health Workshop, January 2025

Wallis Robinson – UC Cooperative Extension Humboldt/Del Norte

Nurseries: Home to plants and pathogens alike

What's a Phytophthora?

Phyto-phthora

Plant Destroyer

P. cinnamomi

P. lateralis

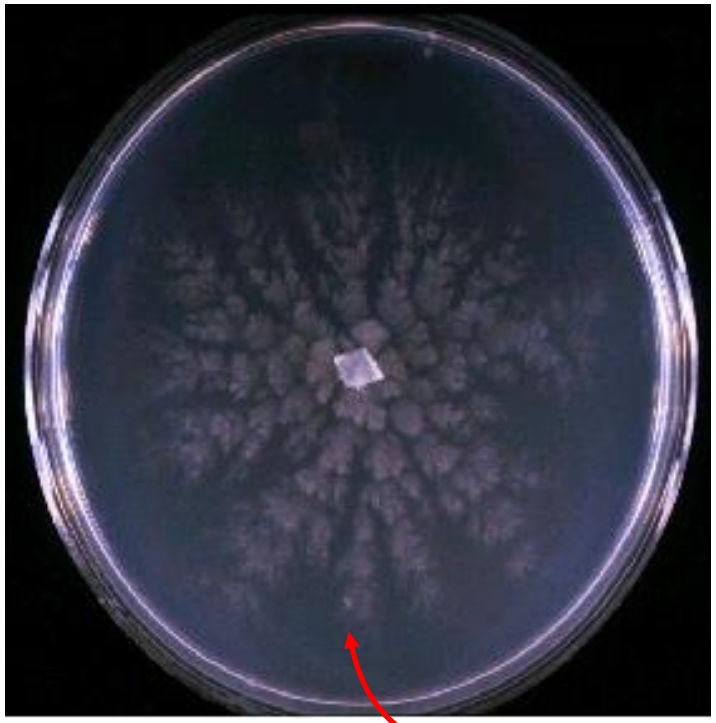
P. ramorum

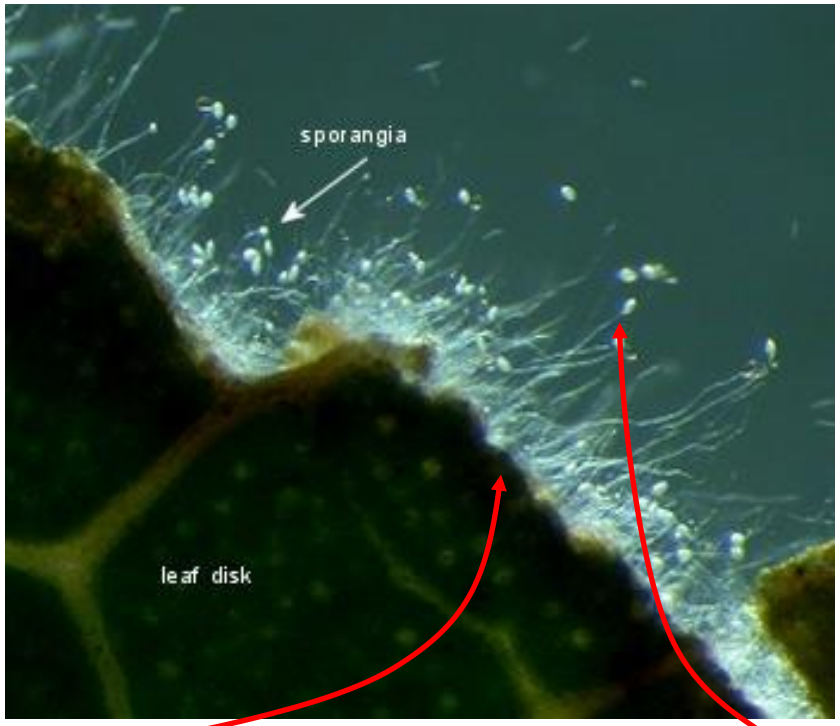
P. infestans

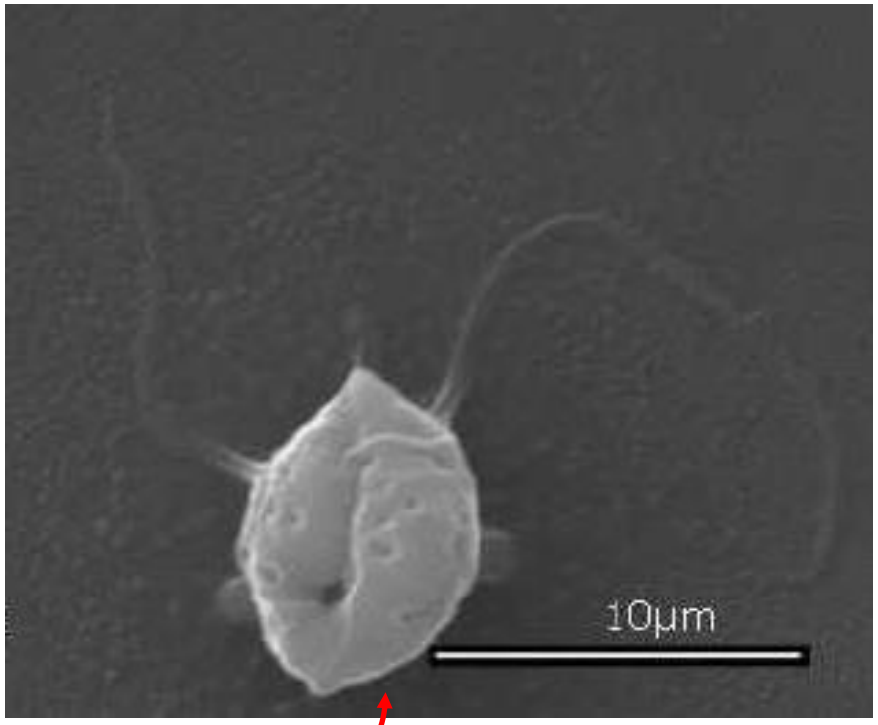
Meet The Plant Destroyers

Phytophthora Biology

Oomycetes (Egg-fungus)/Water Molds







Grows likes a fungus
(Produces hyphae)

Spores can swim
(Flagellate, need water)

Phytophthora Biology

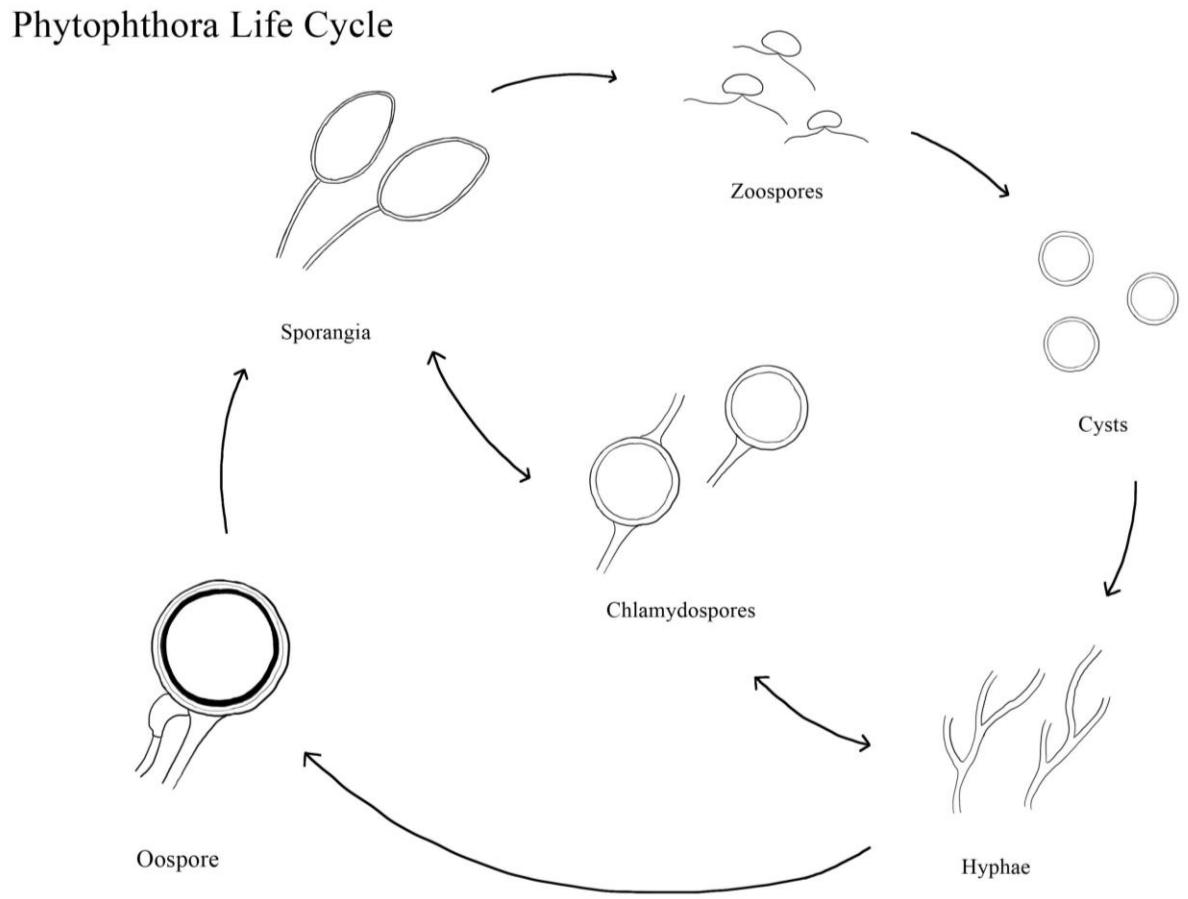
Oomycetes (Egg-fungus)/Water Molds

- Often generalists
- Host species not closely related

Phytophthora Biology

Oomycetes (Egg-fungus)/Water Molds

- Often generalists
- Host species not closely related
- Three types of spores
- Many methods of reproduction and survival



Takeaway:
These are tough, adaptable organisms!

Phytophthora Biology

Soil-borne Phytophthoras

- Spread by wet soil on shoes, tire treads, potted soil, infected roots, runoff

How it spreads

Phytophthora Biology

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Why it's scary

Phytophthora Biology

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How it spreads

Phytophthora Biology

Water/Air-borne Phytophthoras

- Spread by water, infected plant material, moist air, in storms
- Long-distance spread via infected plants and (to a lesser extent) soil

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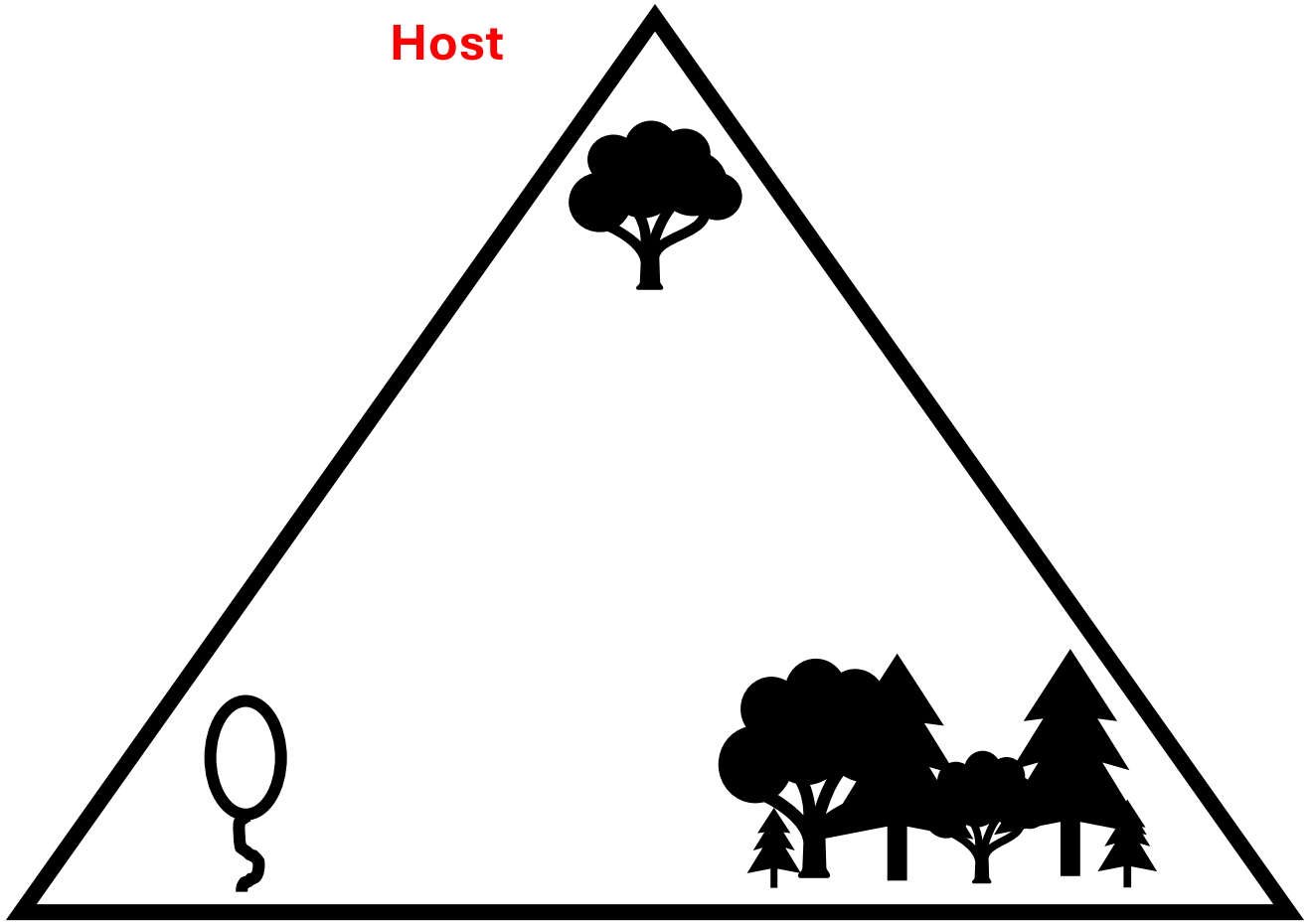
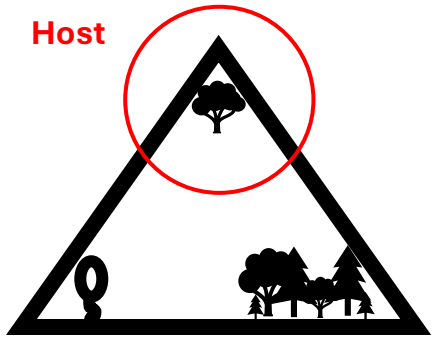
How is this Related to Nurseries?

Nurseries and the Disease Triangle



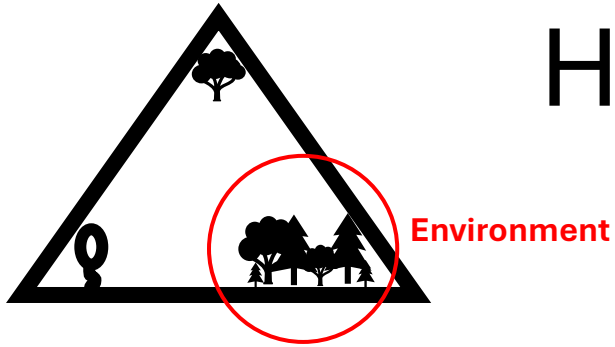


How is this Related to Nurseries?

Host-Related Concerns

Many potential host species of variable susceptibility

Some hosts may be asymptomatic



How is this Related to Nurseries?

Environment-Related Concerns

- Improper or lack of tool, shoe, pot, tire, and soil sanitation
- Plants may be in standing water due to poor drainage
- Plants often close together
- Diseased plants may not be properly disposed of or ignored

Phytosanitary Practices for Nurseries

AIR Program Basics

Home • About AIR • AIR Program Basics

Producing nursery plants free of soilborne *Phytophthora*

All of the clean nursery production best management practices (NPBMPs) have their foundation in a few basic concepts and rules of thumb summarized as *Start Clean, Stay Clean.*

The NPBMPs are simply applications of these rules to specific situations encountered in the plant production process. Because it is not possible to anticipate every possible situation in every nursery, lists of BMPs can have gaps: they may not explicitly cover a particular situation. However, if all nursery workers understand and consistently apply the basic concepts and rules of thumb noted below, they will be able to make informed decisions that are consistent with the NPBMPs and keep *Phytophthora* out of the production system .

Clean Production Benches. Photo credit: Diana Benner

About AIR

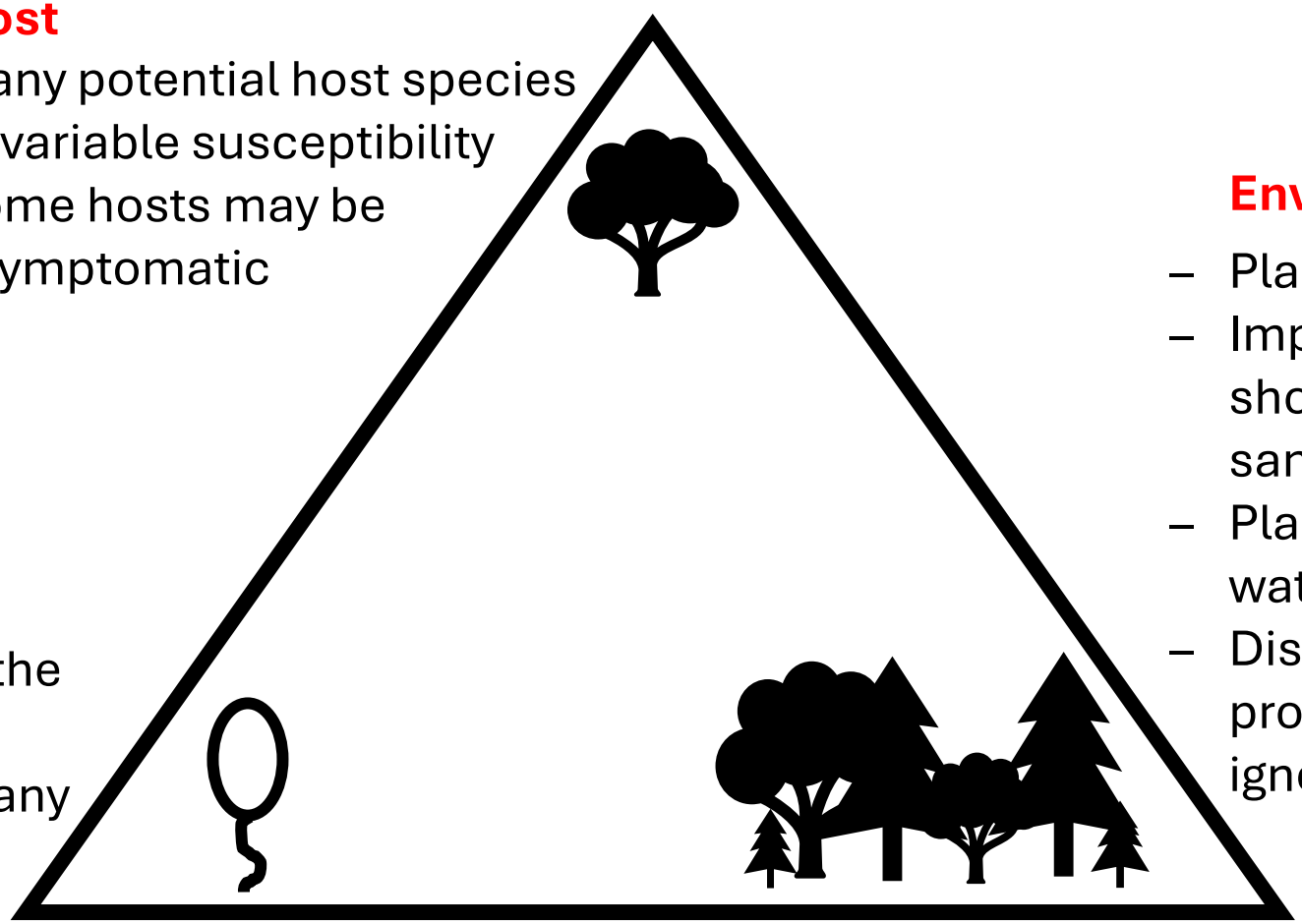
- Program Basics
- Participating Nurseries
- AIR Team
- Partners

How Can We Avoid These Issues?

Good Phytosanitary Practices!

Host

- Many potential host species of variable susceptibility
- Some hosts may be asymptomatic



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- Often generalists with many host species

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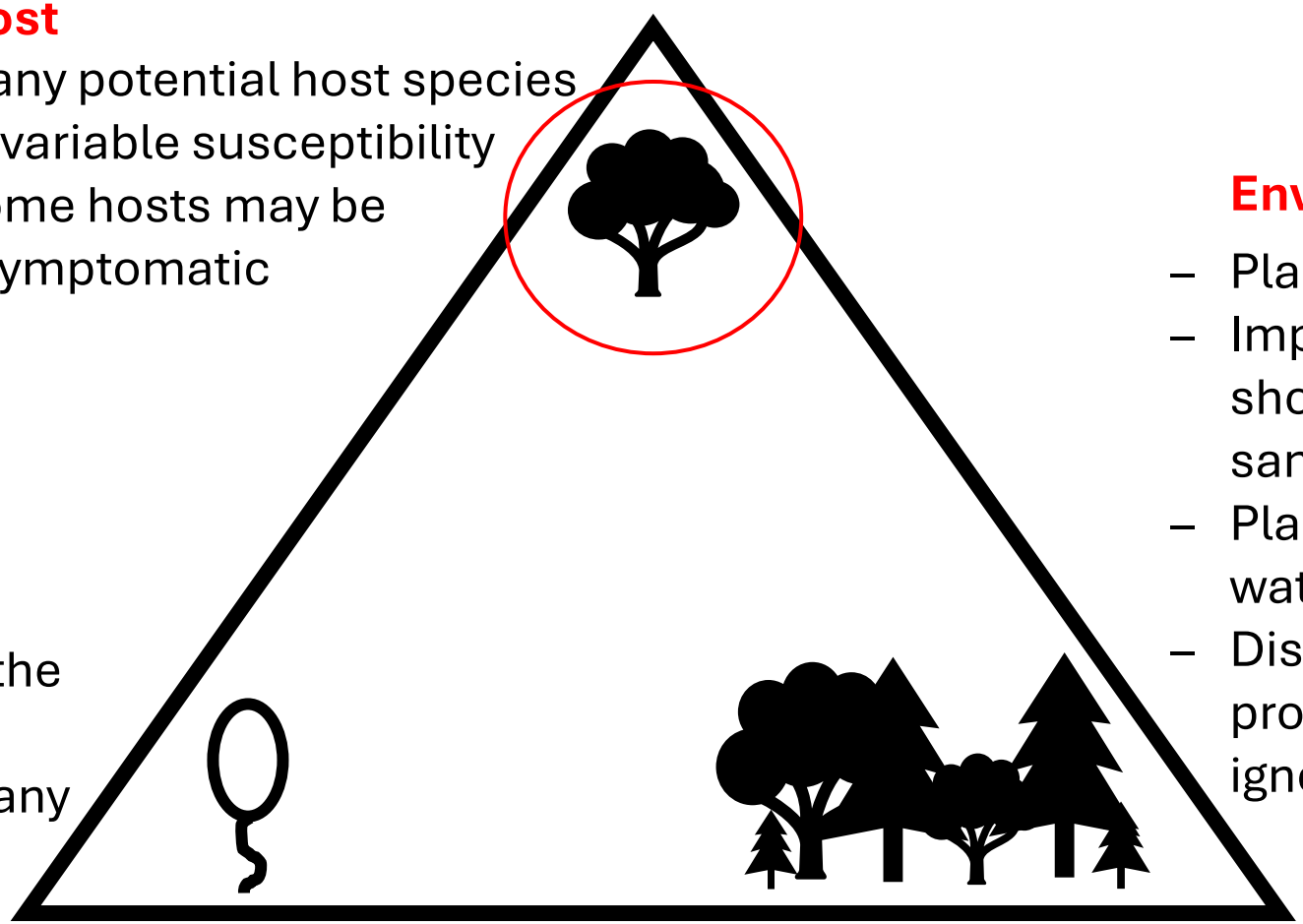

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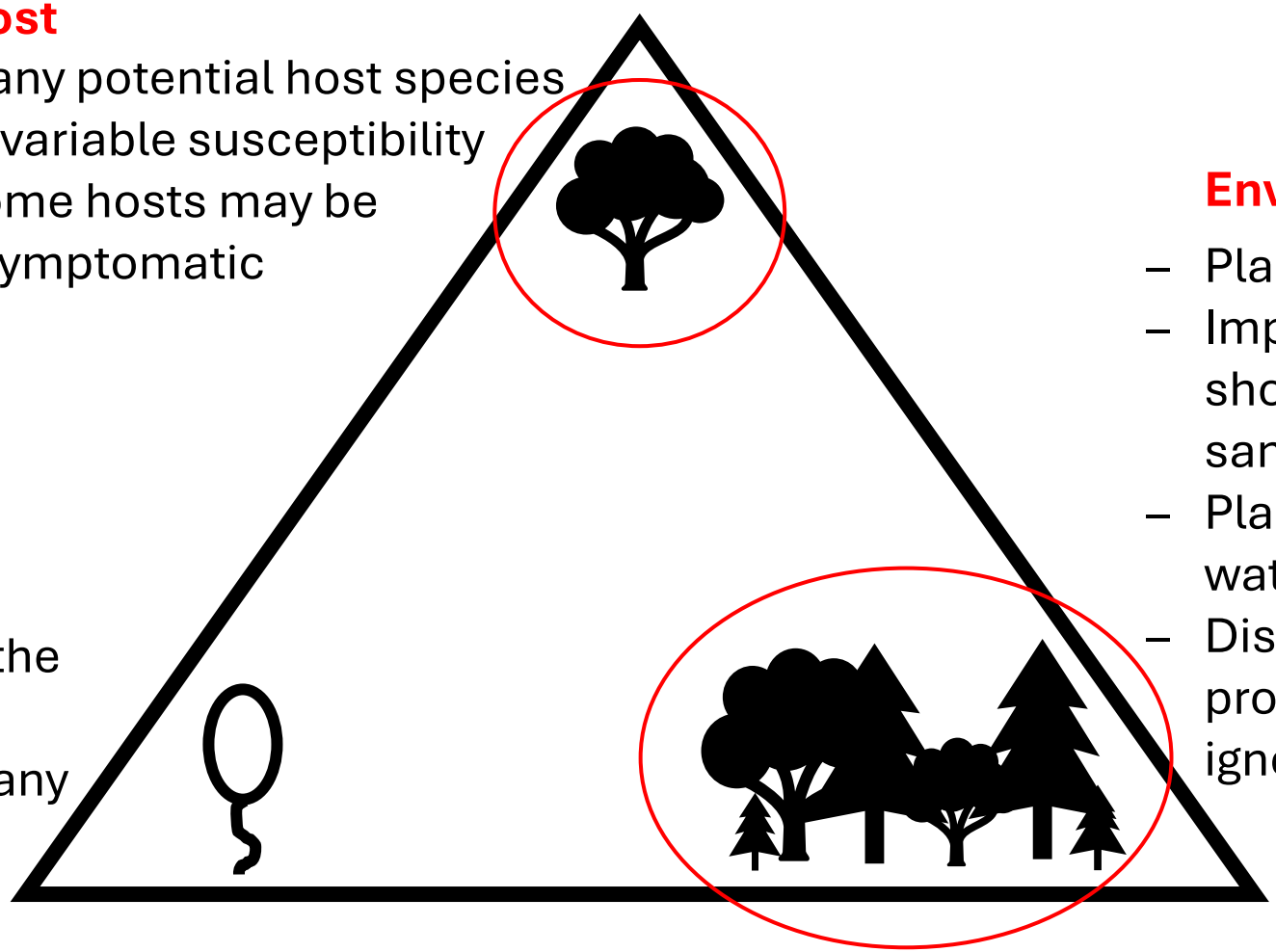

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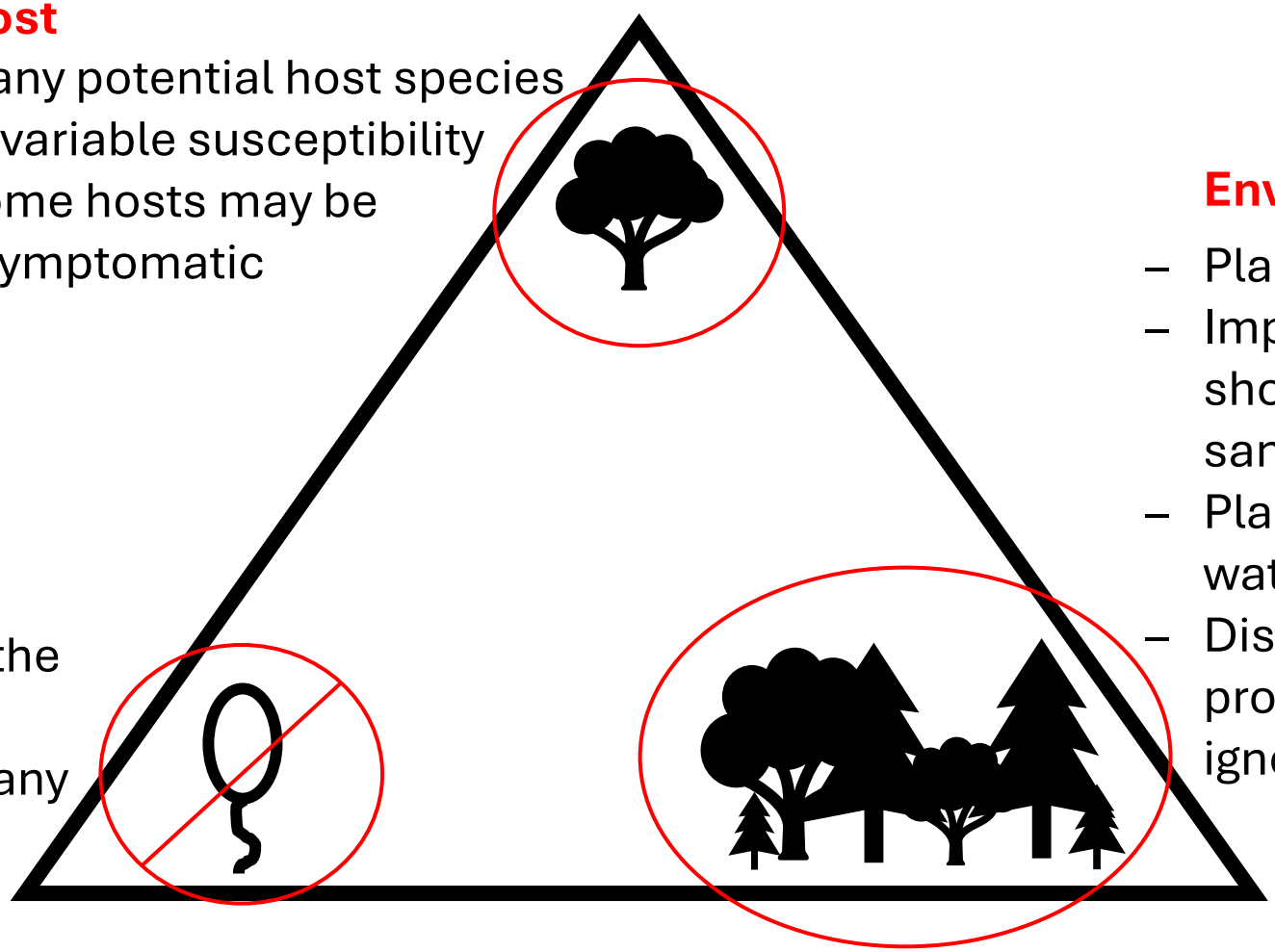

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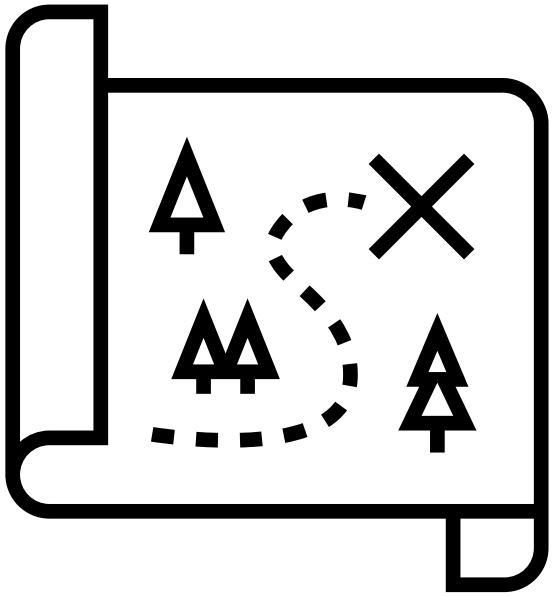
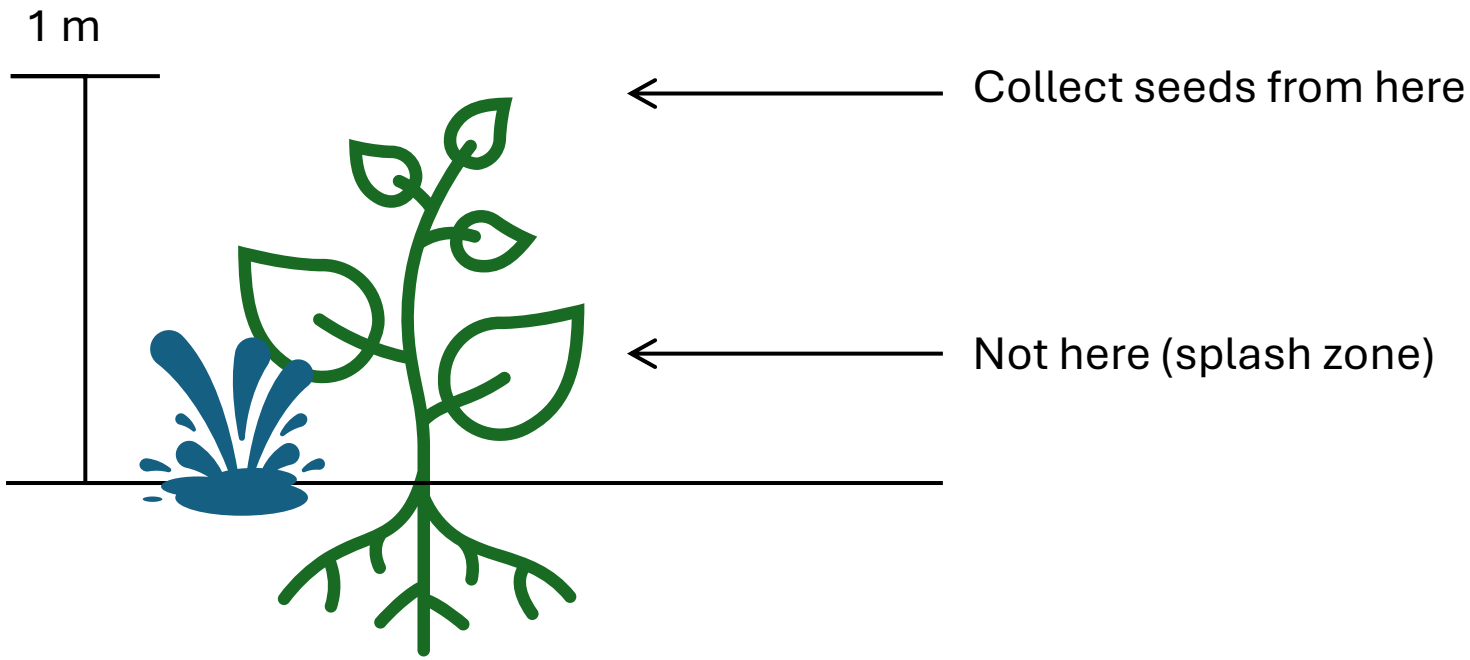
Host-Related BMPs

Where to Find Additional Host BMPs:

- http://phytosphere.com/BMPsnursery/BMP2clnplt.htm
- Page 6 – 7 of Guidelines to Minimize Phytophthora Pathogens in Restoration Nurseries



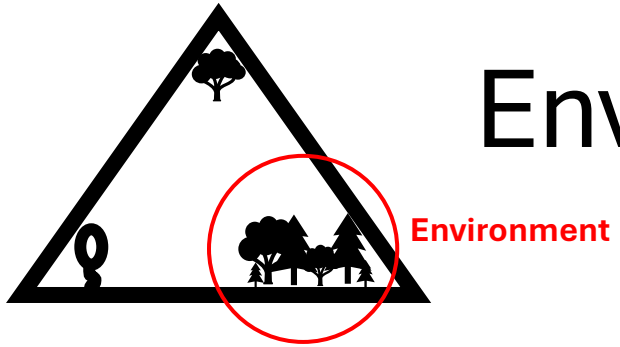


Collect from places *without*:

- Known disease
- Unhealthy-looking plants
- Restoration plantings

Where/when to collect seeds/cuttings:

- From healthy plants
- Above 1 m from ground (if possible)
- Before the rainy season, in dry conditions
- From other nurseries with documented phytosanitary practices



Environment-Related BMPs

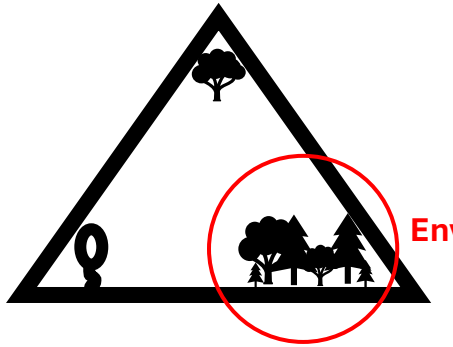
Pot Sanitation

Chemical

- .525% bleach solution
- Must be freshly made (or tested)
- Minimum of 5 minutes for sanitation
- Other sanitizing agents available or upcoming

Heat

- Steam, hot water, or solar
- Moisture matters!
- Wet material: 140 °F for 30 min
- Dry material: 160 °F for 30 min
- Requires thermometers to ensure adequate heating of all material



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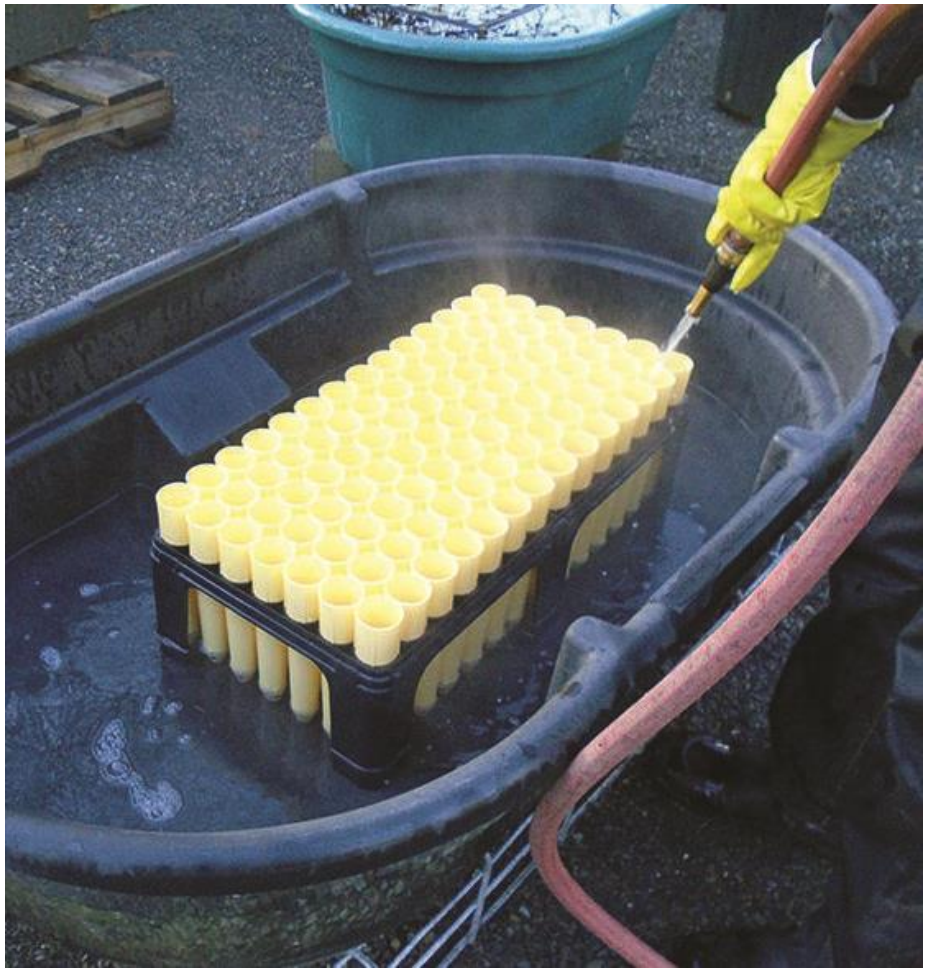
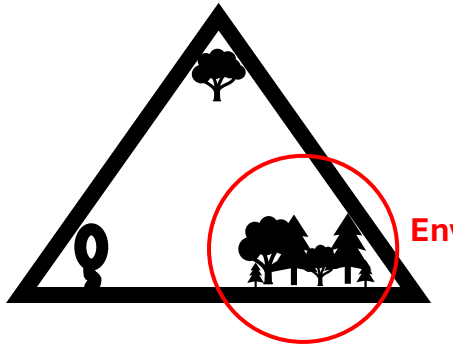




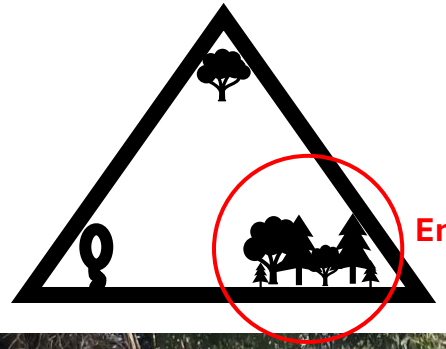
Environment-Related BMPs

Soil Sanitation

Heat

- Steam = most realistic option
- Soil needs to be moist
- 140 °F for 30 min
- > 180 °F = temporary phytotoxicity
- Requires thermometers to ensure adequate heating of all material
- NORS-DUC Steam Engine
- Other options?

NORS-DUC researcher living his best life →



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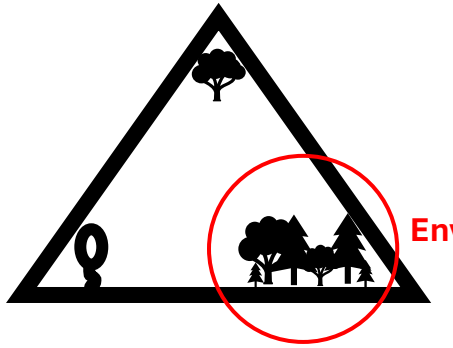
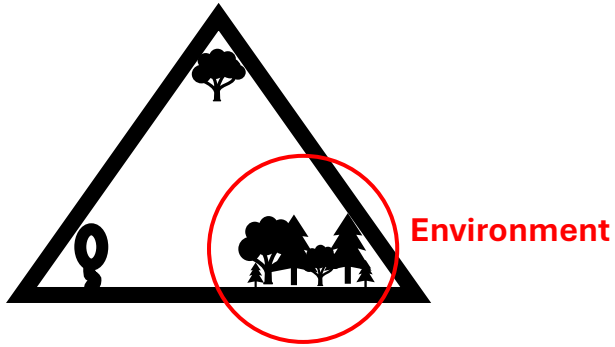


Environment-Related BMPs

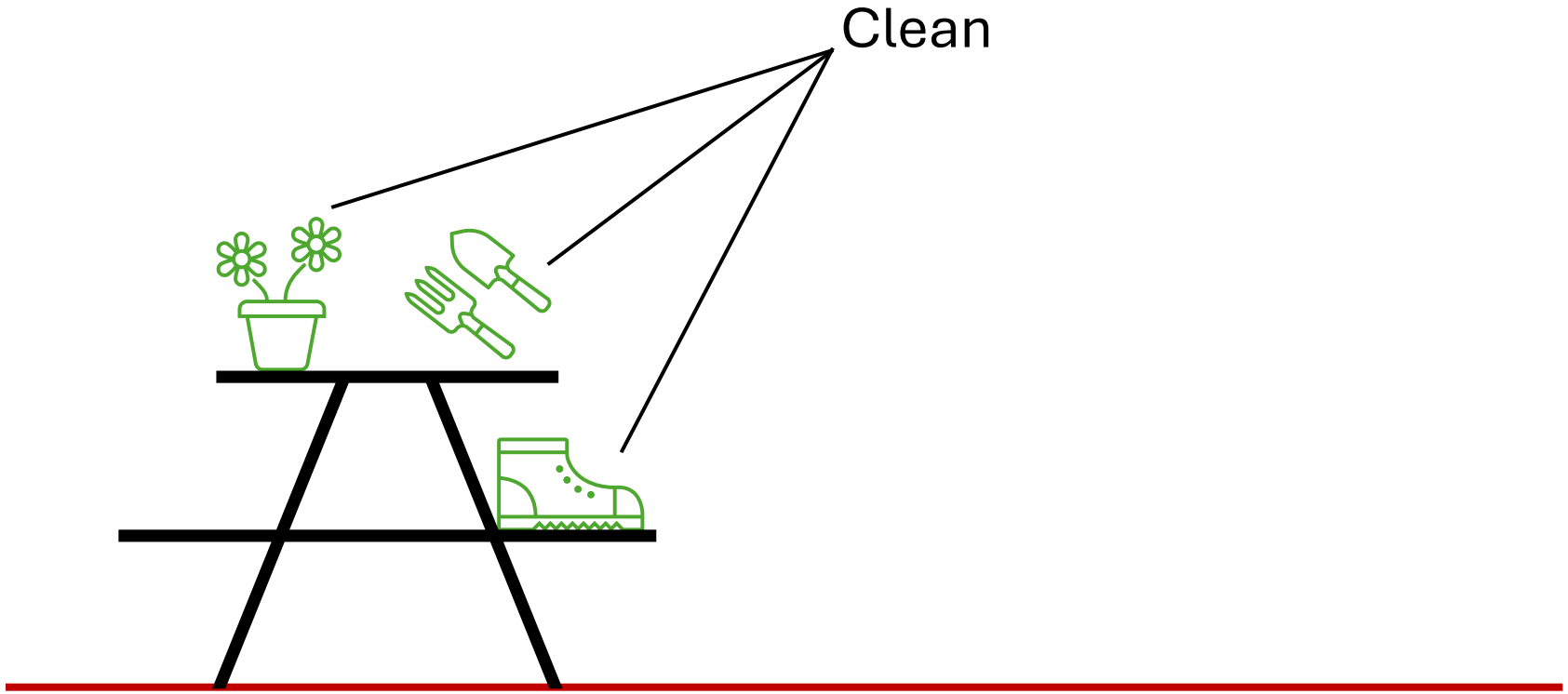
Tool and Shoe Sanitation

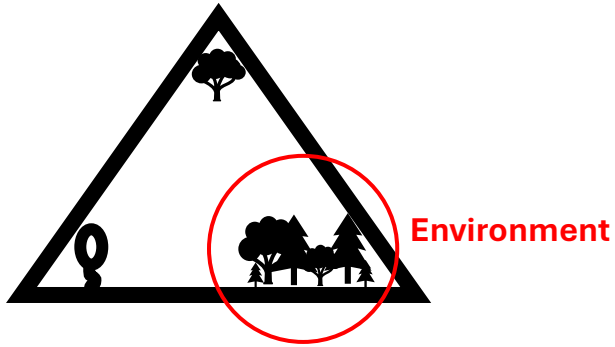
- Same principals as pot sanitation
- More heat = less time
- ≥ 70% ethanol and isopropanol also effective
- Spray bottles are your friend
- Footbaths or shoe cleaning stations between clean and potentially contaminated areas



Environment-Related BMPs

General Production





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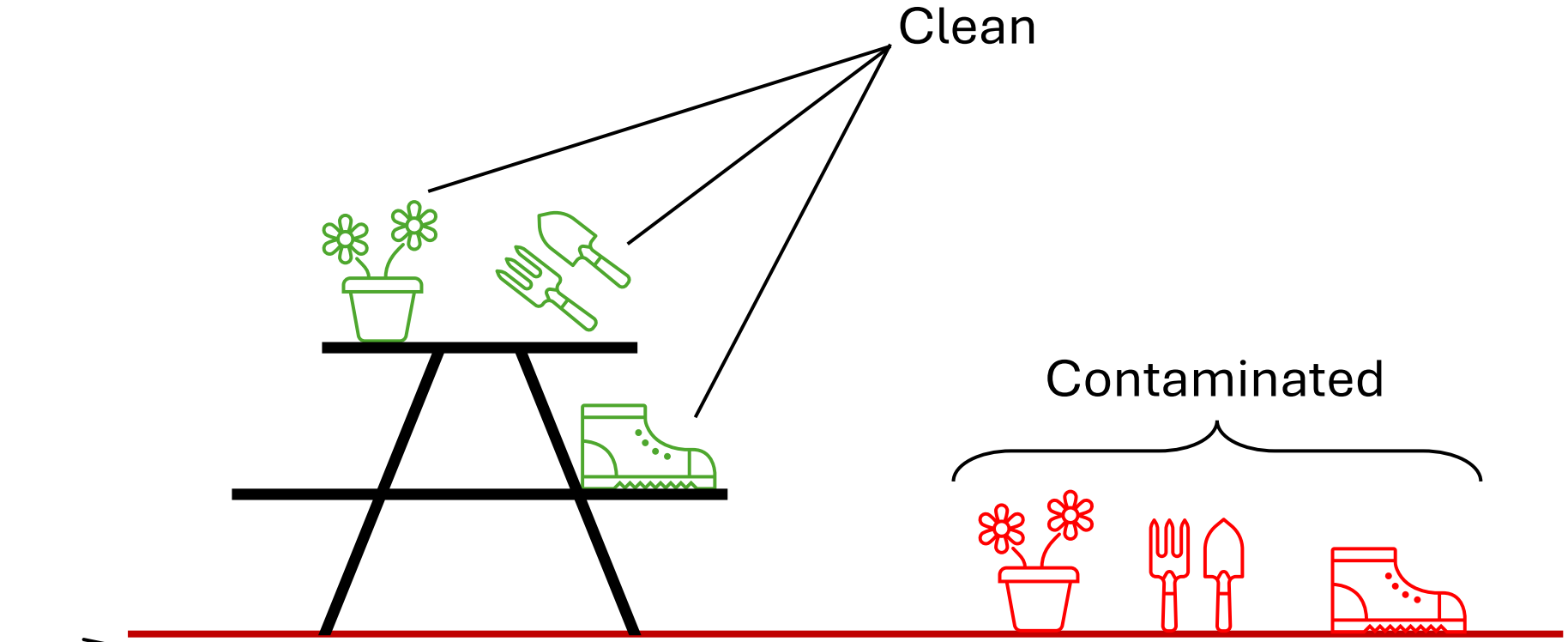
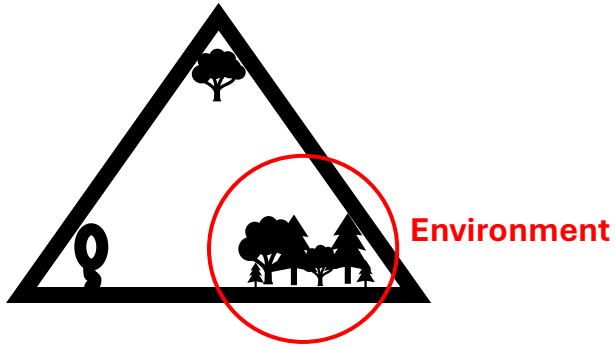


“The ground is lava”



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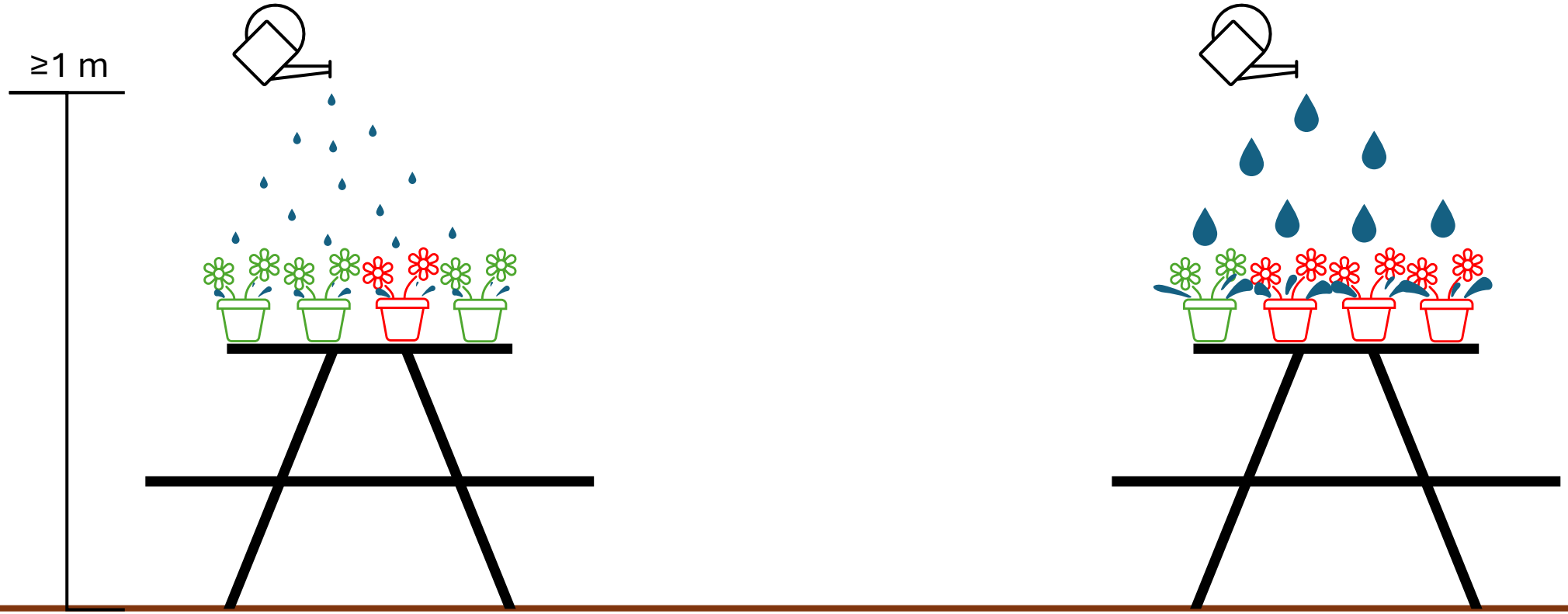

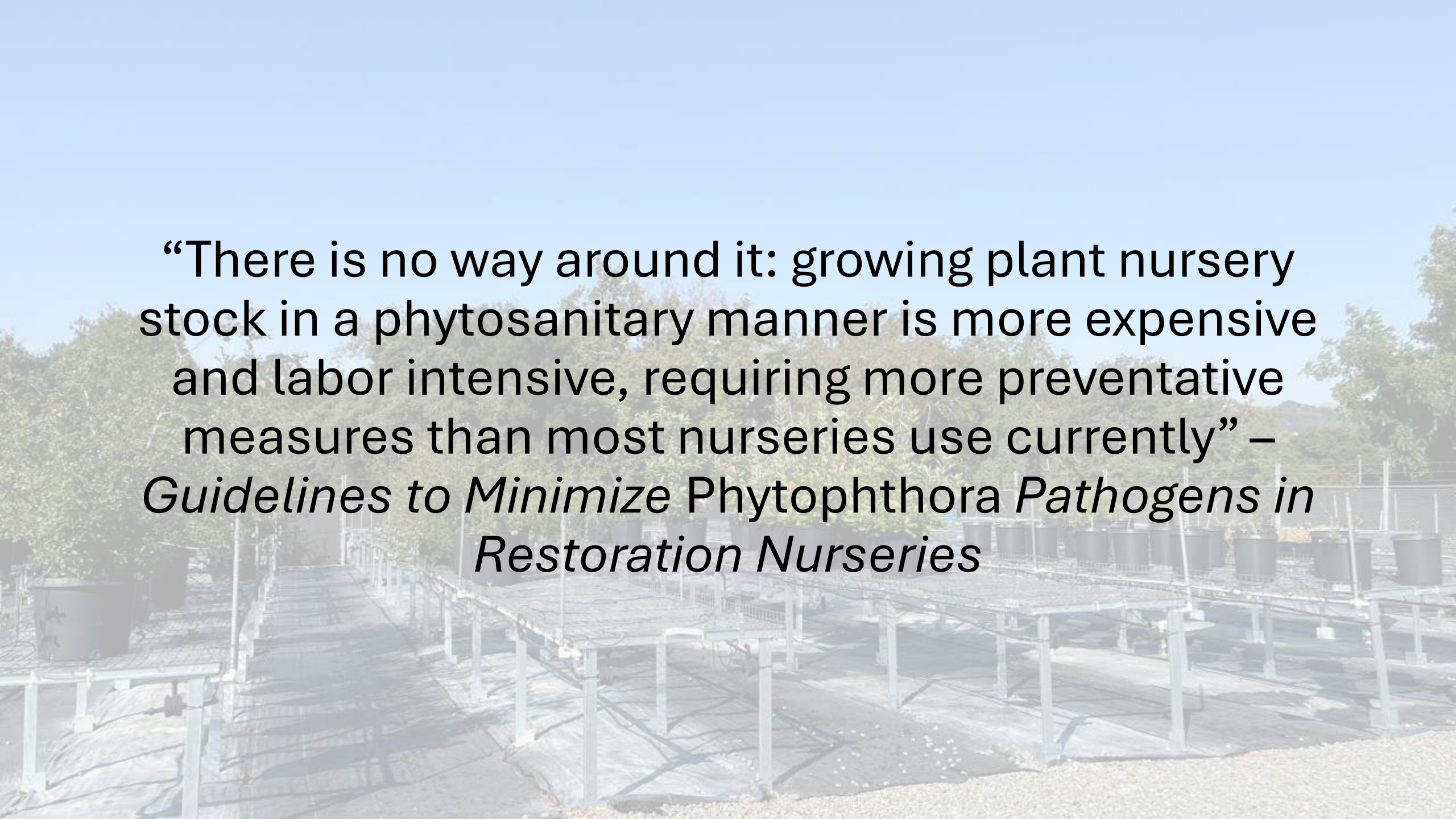

“There is no way around it: growing plant nursery stock in a phytosanitary manner is more expensive and labor intensive, requiring more preventative measures than most nurseries use currently” – *Guidelines to Minimize* Phytophthora *Pathogens in Restoration Nurseries*

Questions to Ask When Identifying Possible Phytophthora Infections

Source: https://extension.oregonstate.edu/catalog/pub/em-9330-preventing-phytophthora-infestations-restoration-nurseries

1. What does a healthy plant look like?

"Are they supposed to look like that?"

- Entering dormant period can look like decline
- Different plants have different signs of stress
- Check for differences between individuals

< What is going on here?

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Green, healthy leaves throughout plant

Yellowing leaves next to green-leaved plant and dead branches near root collar

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2. What does the distribution of symptomatic plants look like?

Uneven distribution of symptomatic plants = more likely pest or pathogen

Even distribution of symptomatic plants = more likely water or mineral issue

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3. What symptoms do I see?

Waterlogged spotting or wilted leaves:

Questions to Ask When Identifying Possible Phytophthora Infections

3. What symptoms do I see?
Shoot dieback, Crown thinning

Questions to Ask When Identifying Possible Phytophthora Infections

Source: https://extension.oregonstate.edu/catalog/pub/em-9330-preventing-phytophthora-infestations-restoration-nurseries

3. What symptoms do I see? Lack of fine roots, dark root collar

I Found a Sick Plant! Now What?

1. For nurseries and gardens, contact the ag department.
2. If you see something in wildlands, you can call the ag department or the UC Cooperative Extension

Sources and Further Reading

Phytophthoras in Nurseries Resources

OSU's Phytophthora in Nurseries Page: https://extension.oregonstate.edu/catalog/pub/em-9330-preventing-phytophthora-infestations-restoration-nurseries

NORS-DUC: https://www.dominican.edu/directory/national-ornamentals-research-site-nors-duc

AIR Certification Program: https://airnursery.ucdavis.edu/

Phytosphere: http://phytosphere.com/soilphytophthora/Issues_implications_Phytophthora_container_stock.htm

Phytophthora Biology: https://forestphytophthoras.org/phytophthora-basics

SOD Resources

Oak Mortality Taskforce: https://www.suddenoakdeath.org/

SOD in Humboldt and Del Norte: https://cehumboldt.ucanr.edu/Programs/Forestry/Sudden_Oak_Death/