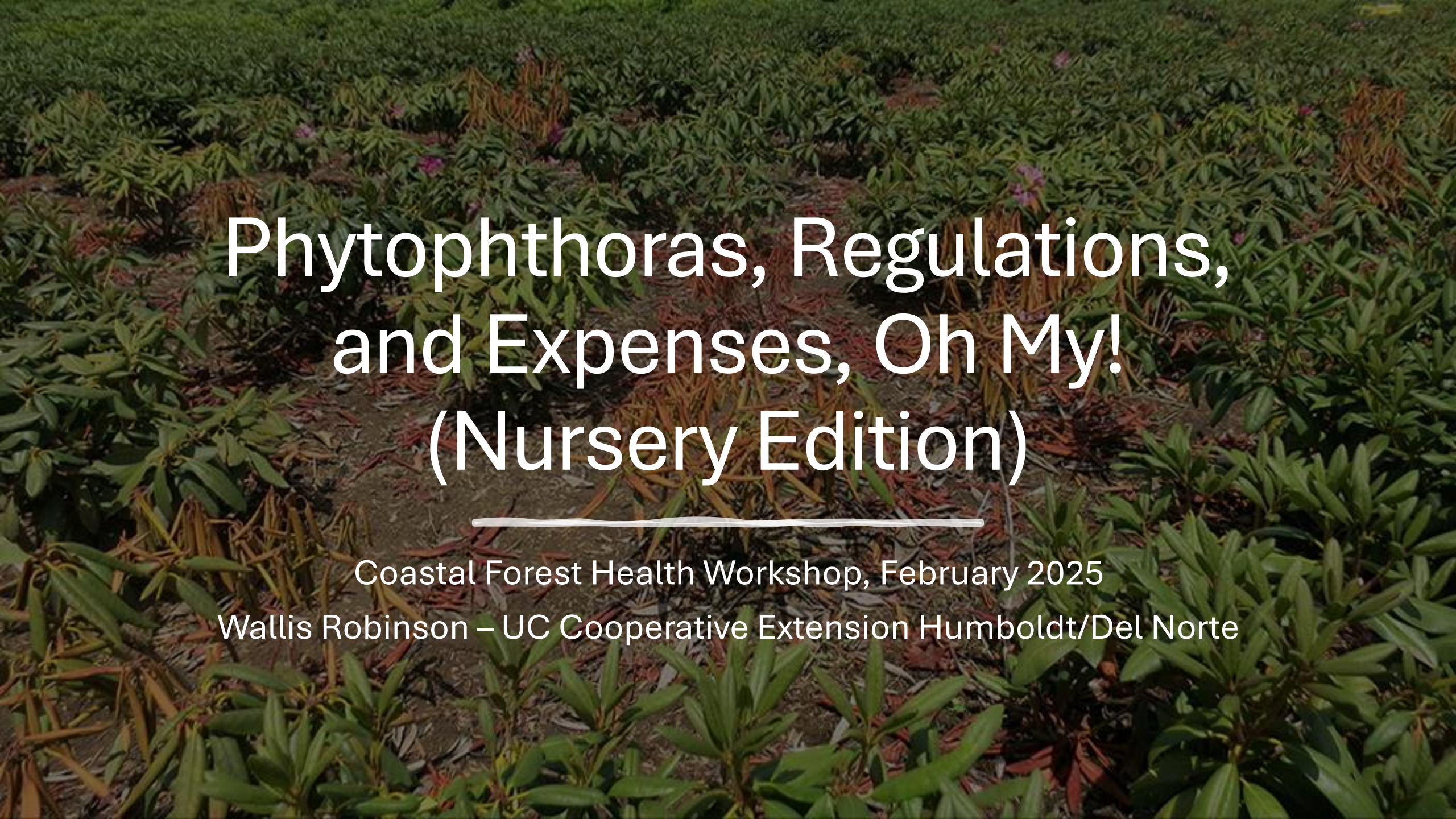


Phytophthoras, Regulations, and Expenses, Oh My! (Nursery Edition)

Coastal Forest Health Workshop, February 2025

Wallis Robinson – UC Cooperative Extension Humboldt/Del Norte

What's a Phytophthora?

Phyto-phthora

Plant Destroyer

P. cinnamomi

P. lateralis

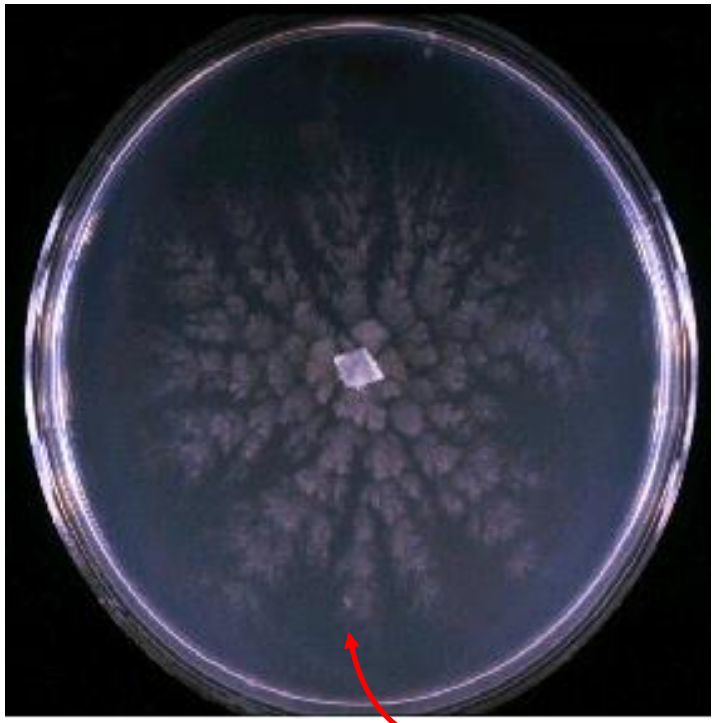
P. ramorum

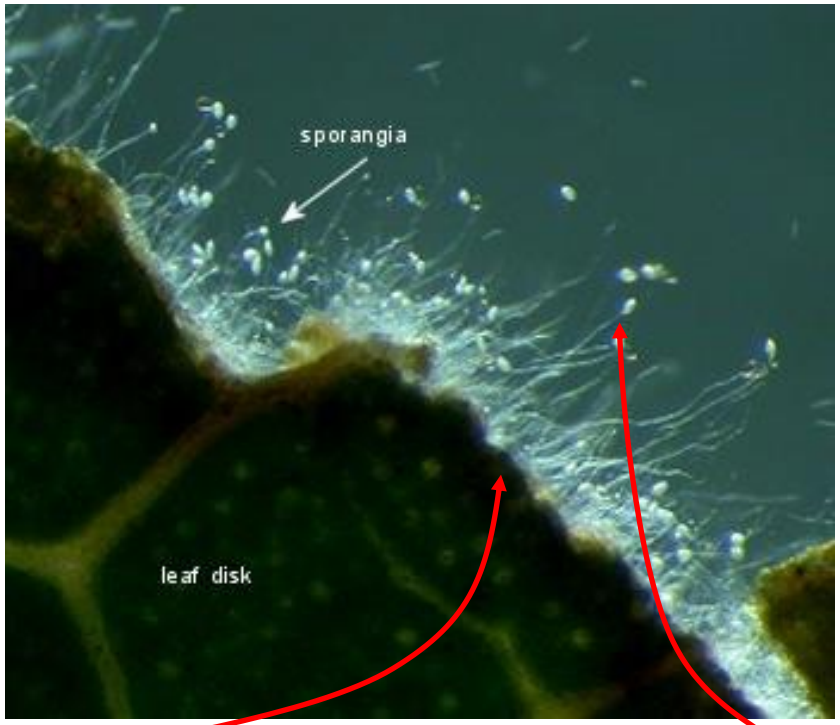
P. infestans

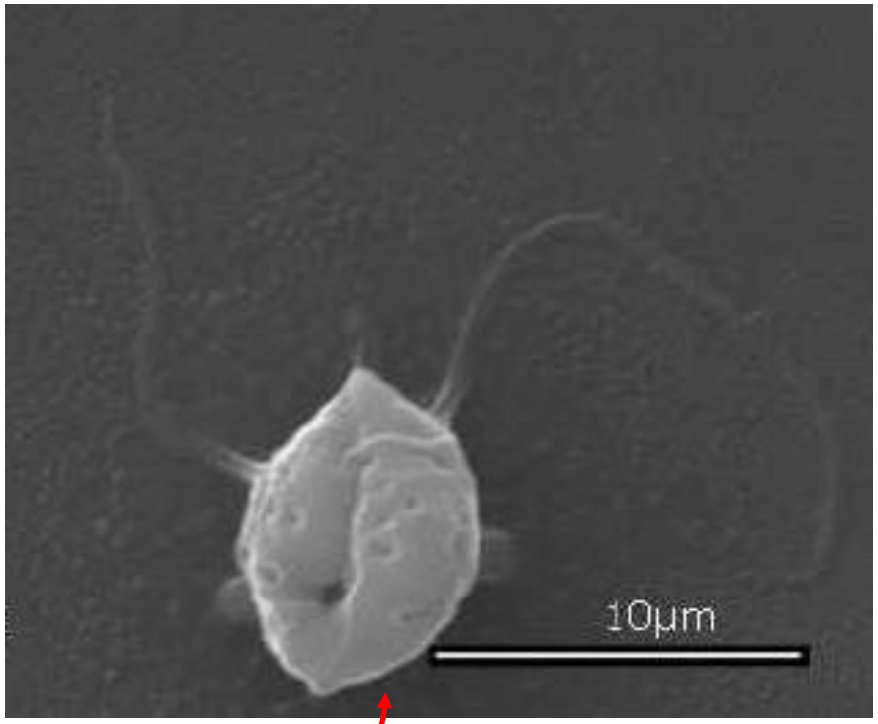
Meet The Plant Destroyers

Phytophthora Biology

Oomycetes (Egg-fungus)/Water Molds







Grows likes a fungus
(Produces hyphae)

Spores can swim
(Flagellate, need water)

Phytophthora Biology

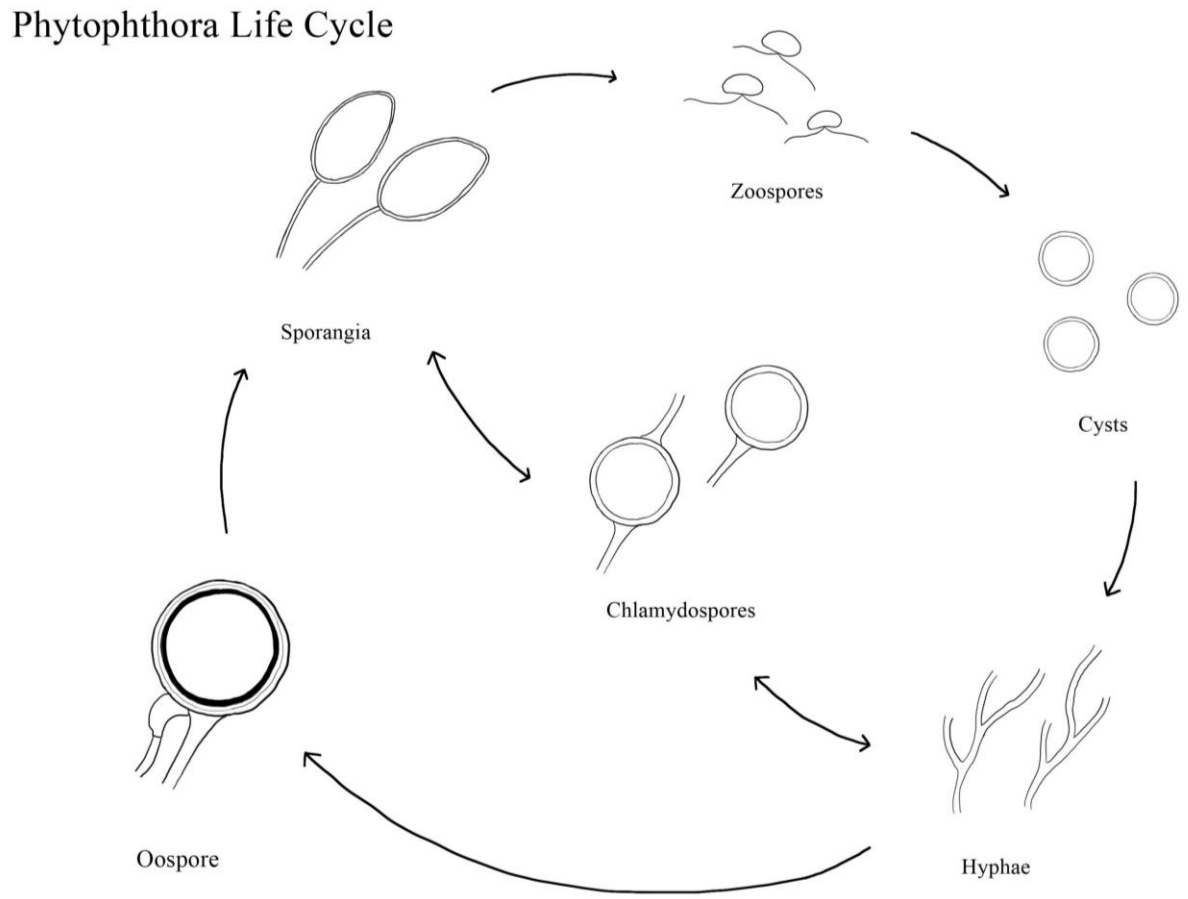
Oomycetes (Egg-fungus)/Water Molds

- Often generalists
- Host species not closely related

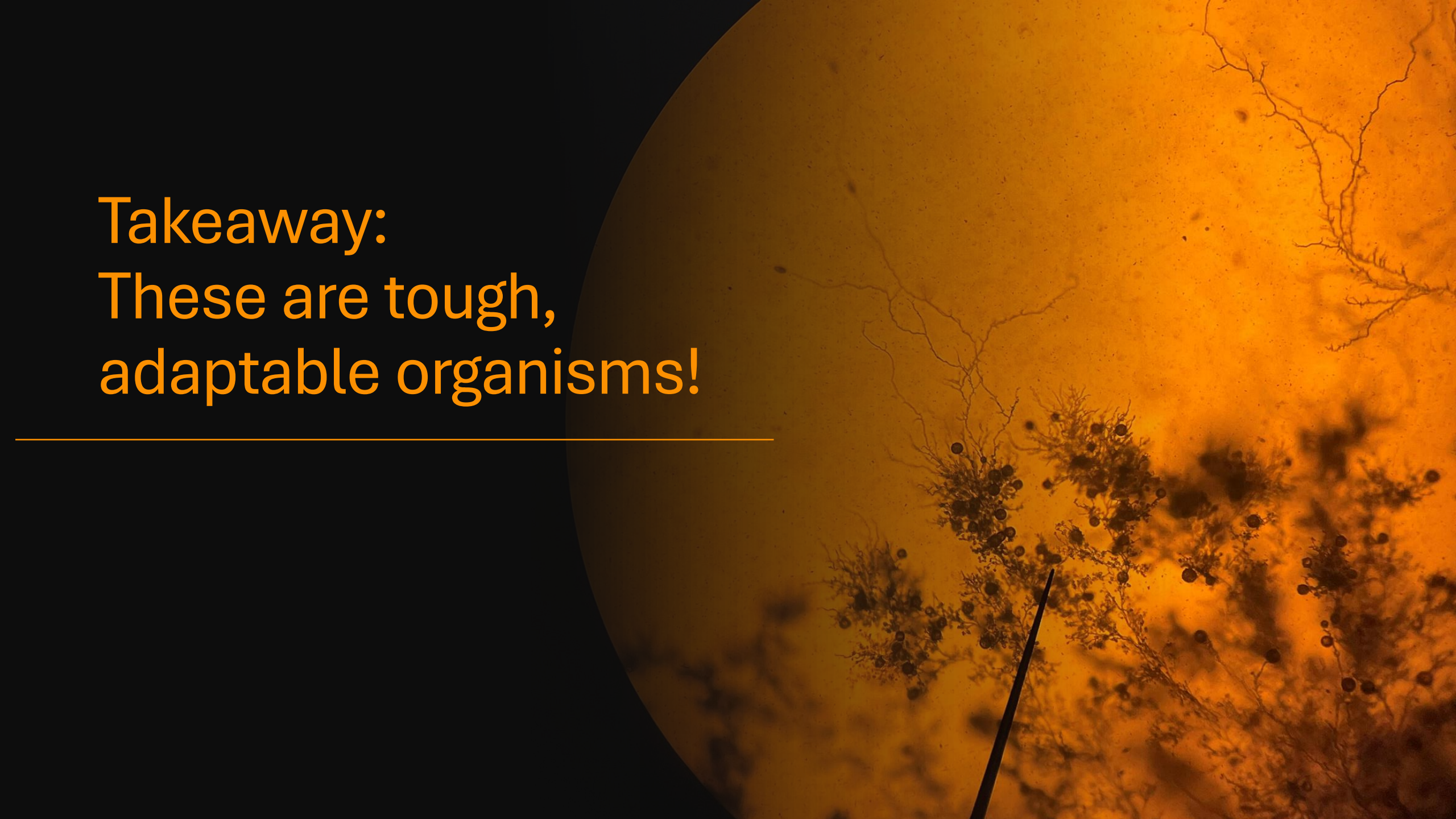
Phytophthora Biology

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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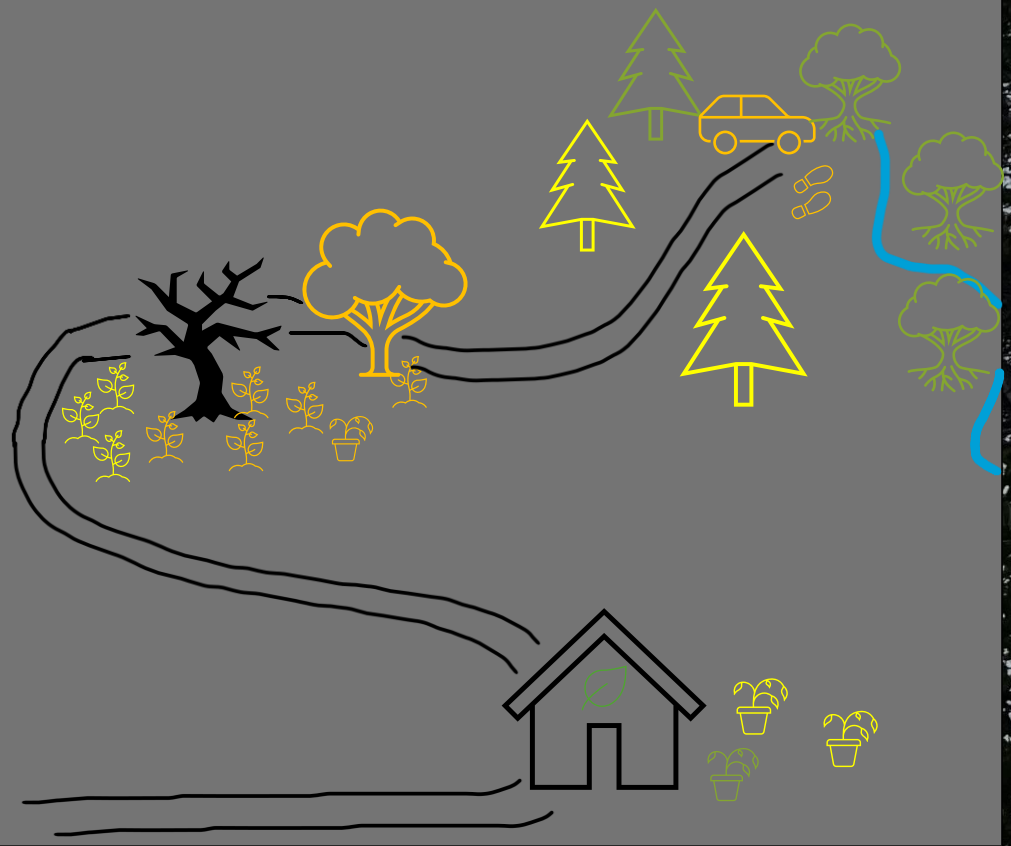

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Why it's scary

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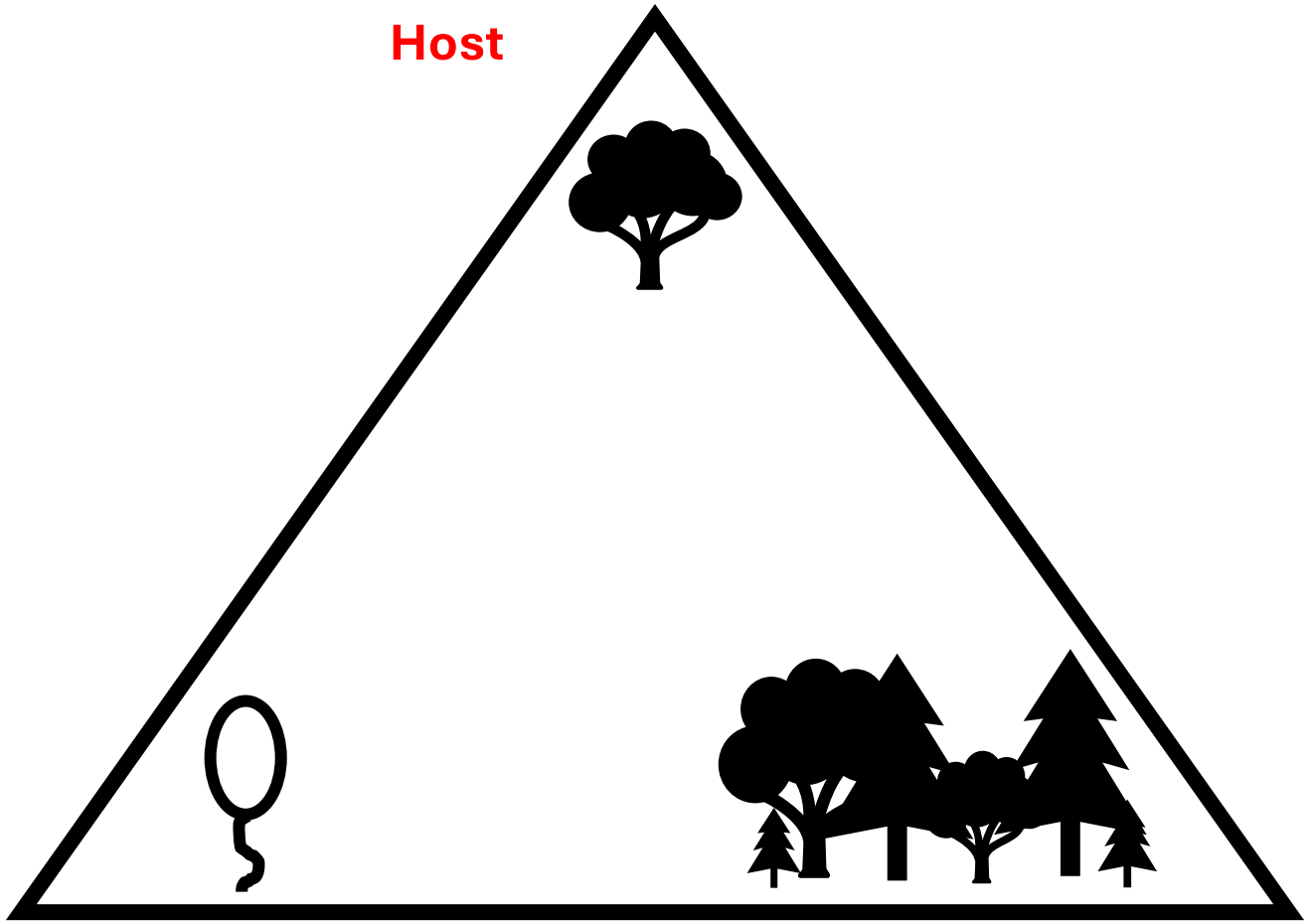
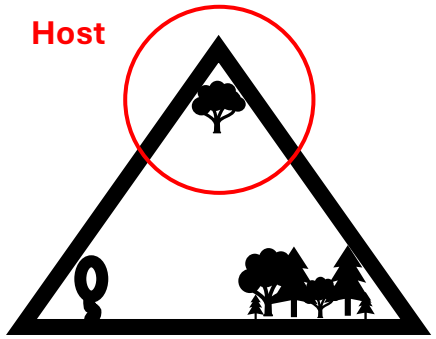
How is this Related to Nurseries?

Nurseries and the Disease Triangle





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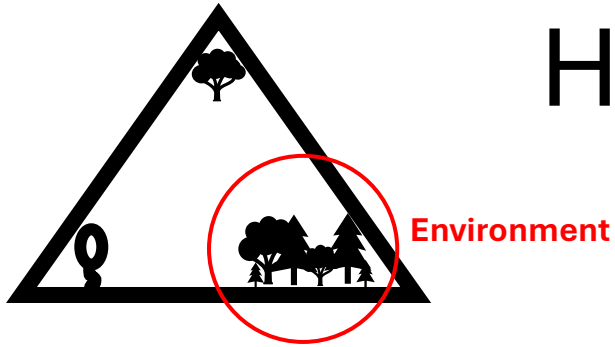
Host-Related Concerns

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

Regulations Pt 1: Who regulates where?

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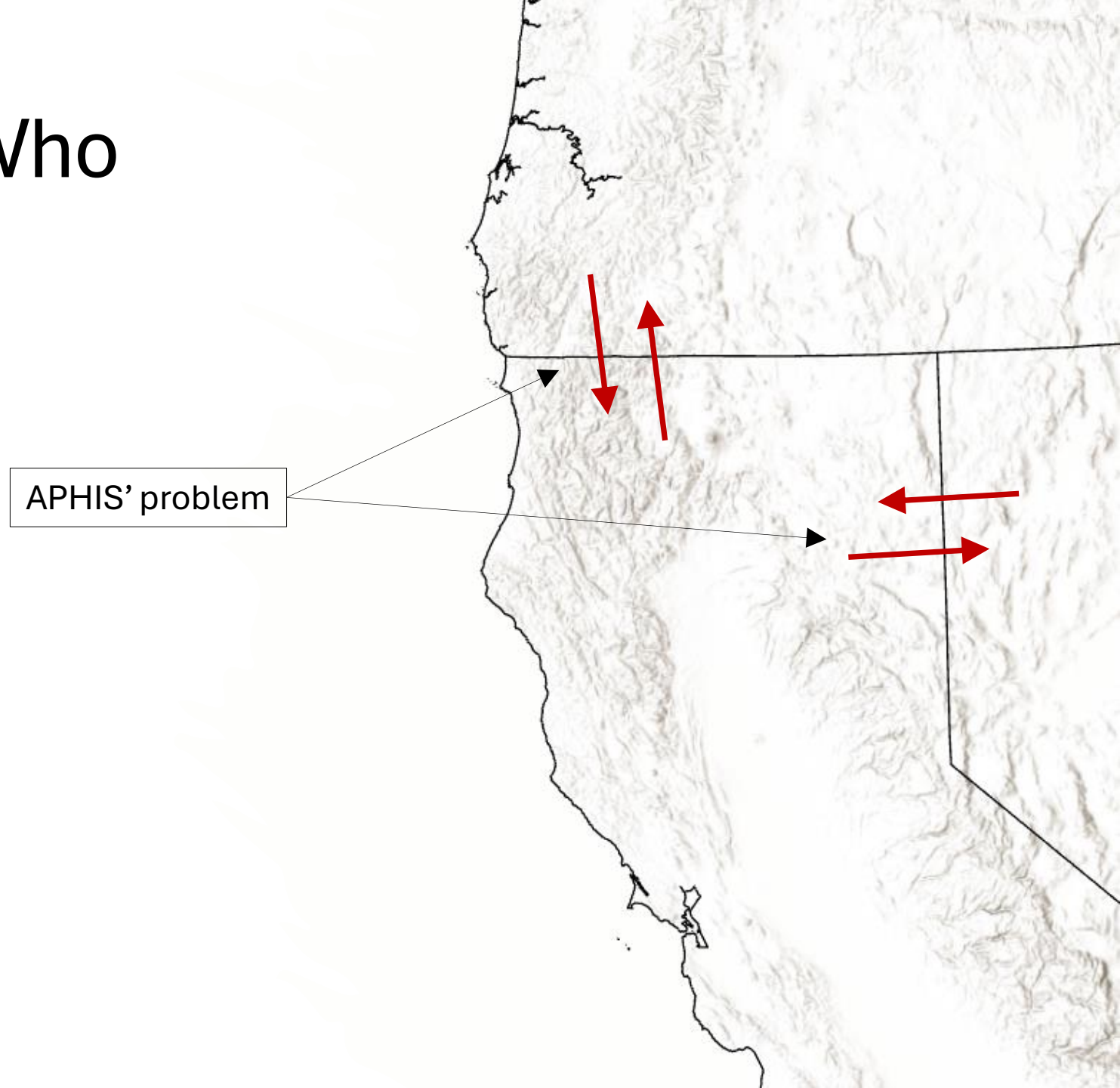
- APHIS → Interstate movement of products



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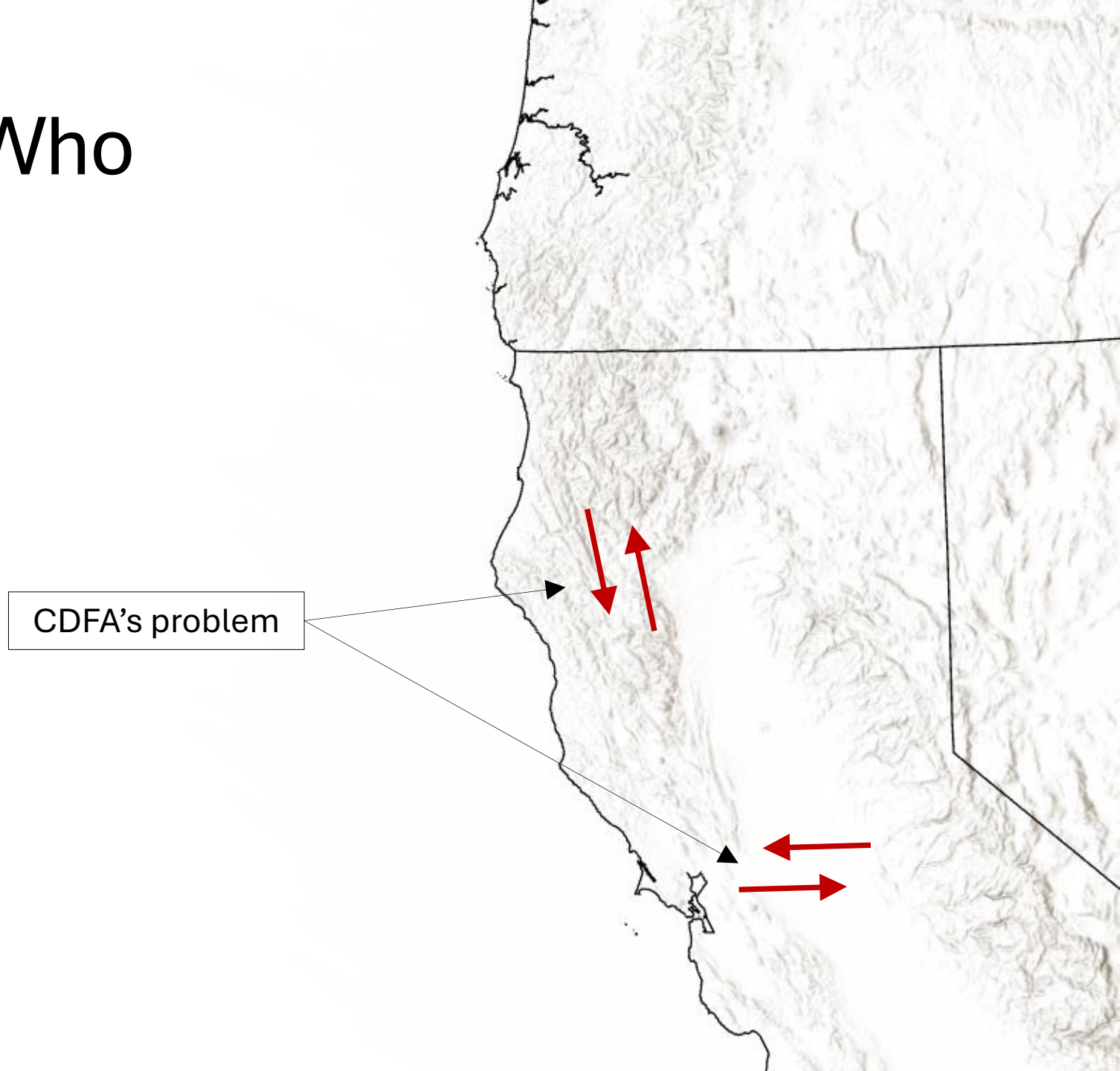

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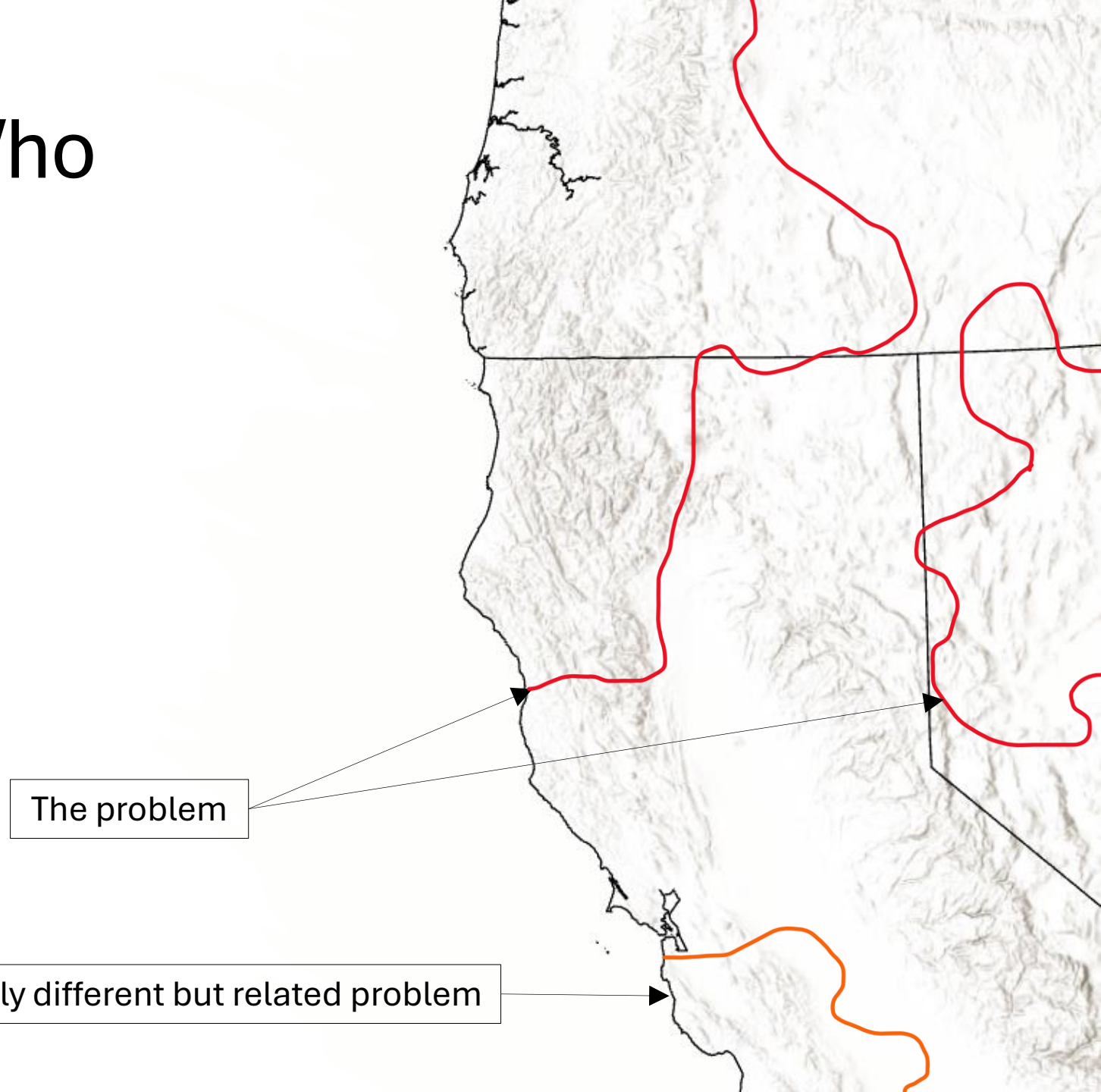
- APHIS → Interstate movement of products
- CDFA → Intrastate movement of products
- Mismatch of regulatory boundaries and disease boundaries



Regulations Pt 2: What gets regulated?

CALIFORNIA DEPARTMENT OF FOOD AND AGRICULTURE
PLANT QUARANTINE MANUAL

COUNTY RESTRICTIONS ON GLASSY-WINGED SHARPSHOOTER

Foreword

Several counties notified the Department that the hold exemption authorized by Food and Agricultural Code Section 6504 is waived for shipments of specific kinds of nursery stock. This action was taken to protect the counties' agricultural industry, particularly the grape industry, from the introduction of *Homalodisca vitripennis*, the glassy-winged sharpshooter (GWSS), which is a vector of *Xylella fastidiosa*, the causal agent of Pierce's disease, from GWSS infested areas.

Counties Enforcing Restrictions

Alameda, Amador, Butte, Calaveras, Colusa, Contra Costa, El Dorado, Fresno, Glenn, Humboldt, Imperial, Kern, Kings, Lake, Madera, Marin, Mariposa, Mendocino, Merced, Monterey, Napa*, Nevada, Placer, Sacramento, San Benito, San Francisco, San Joaquin, San Luis Obispo, San Mateo, Santa Barbara, Santa Clara, Santa Cruz, Shasta, Solano, Sonoma*, Stanislaus, Sutter, Trinity, Tehama, Tulare, Tuolumne, Yolo, and Yuba.

*See Appendix A for additional restrictions.

Regulated Articles

"Host material" shall mean all nursery stock or food host plants as referenced in Appendix A of State Miscellaneous Rulings: Pierce's Disease Control Program, pages 454.3 through 454.7.

CALIFORNIA DEPARTMENT OF FOOD AND AGRICULTURE
PLANT QUARANTINE MANUAL

301.92 *Phytophthora ramorum*

Federal Domestic Quarantine

Sec. 301.92 Restrictions on Interstate Movement

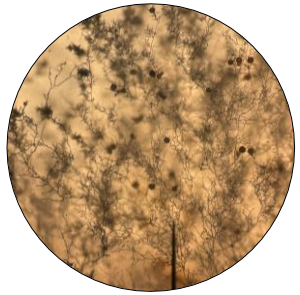
(a) No person may move interstate from any quarantined area any regulated, restricted, or associated article or any other nursery stock except in accordance with this subpart.[1]

[1]Any properly identified inspector is authorized to stop and inspect persons and means of conveyance and to seize, quarantine, treat, apply other remedial measures to, destroy, or otherwise dispose of regulated or restricted articles as provided in sections 414, 421, and 434 of the Plant Protection Act (7 U.S.C. 7714, 7731, and 7754).

(b) No person may move interstate from any regulated establishment any regulated, restricted, or associated articles except in accordance with this subpart.

(c) No person may move interstate from any quarantined area or regulated establishment any regulated restricted, or associated article or nursery stock that has been tested with a test approved by APHIS and found infected with *Phytophthora ramorum*, or that is part of a plant that was found infected with *Phytophthora ramorum*, unless such movement is in accordance with part 330 of this chapter.

[72 FR 8597, Feb. 27, 2007, as amended at 84 FR 16192, Apr. 18, 2019]



CALIFORNIA DEPARTMENT OF FOOD AND AGRICULTURE
PLANT QUARANTINE MANUAL

3288. EMERALD ASH BORER

State Exterior Quarantine

A quarantine is established against the following pest, its hosts, and possible carriers:

A. Pest. Emerald ash borer (*Agrilus planipennis*), a beetle in the Order Coleoptera, Family Buprestidae.

B. Definitions.

(1) "Infestation" means an established, reproducing population of emerald ash borer as designated or determined by the Department **according to Definition 7, below, or when an area has been reported to be infested by the United States Department of Agriculture or a state plant regulatory agency.**

(2) "Living Life Stage" means all life stages of the emerald ash borer, including, but not limited to, adults, **larvae, pupae, or eggs.**

(3) "Move; movement" means shipped, received for shipment, carried, transported, or relocated into or through any area of the State/Province of the infested area.

(4) "Moving through the quarantined area" means the regulated article, including the vehicle and conveyance, is moved directly through the infested area without stopping (except for refueling or for traffic control devices or conditions) and has been stored, packed, or handled only at locations outside the infested area.

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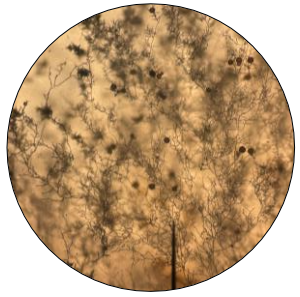

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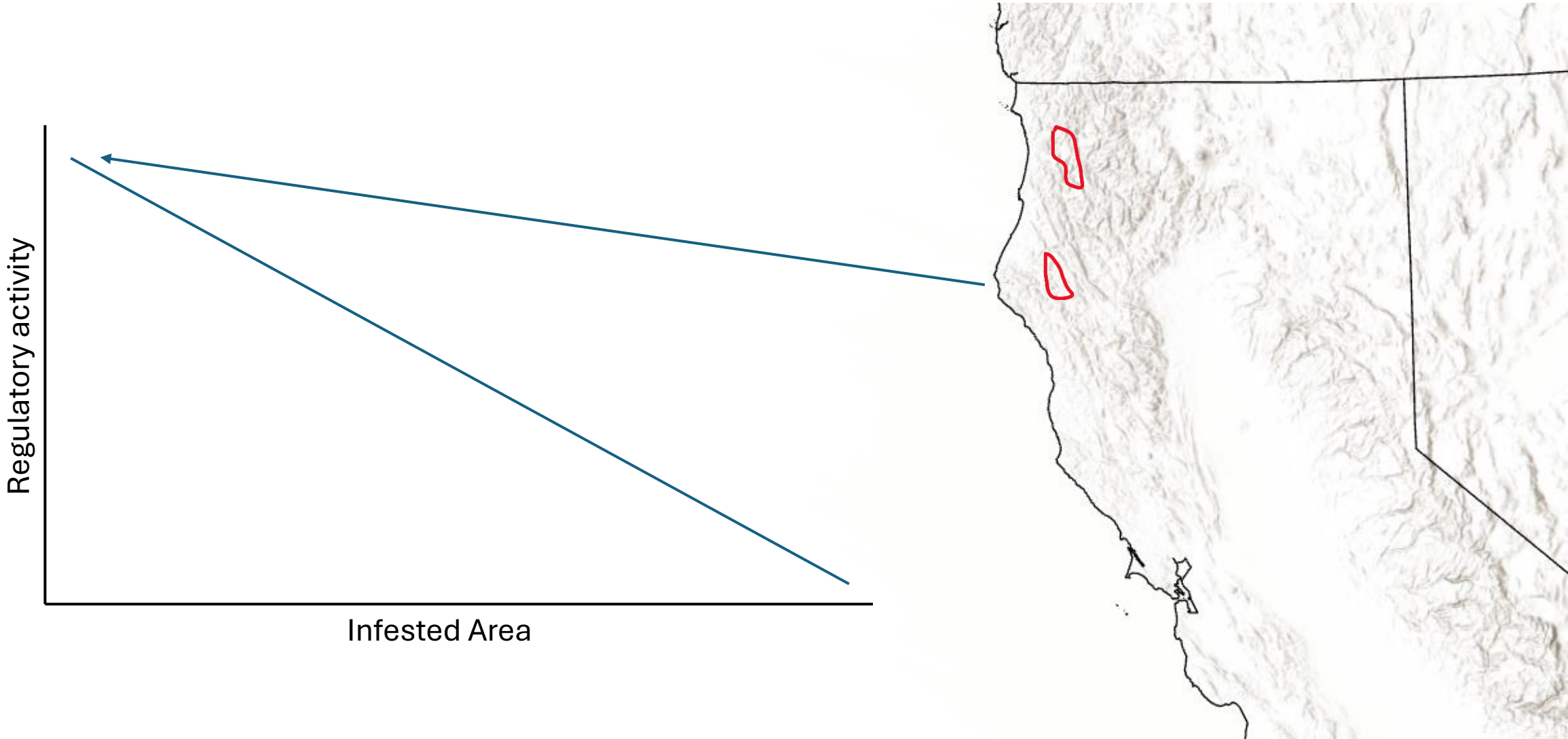

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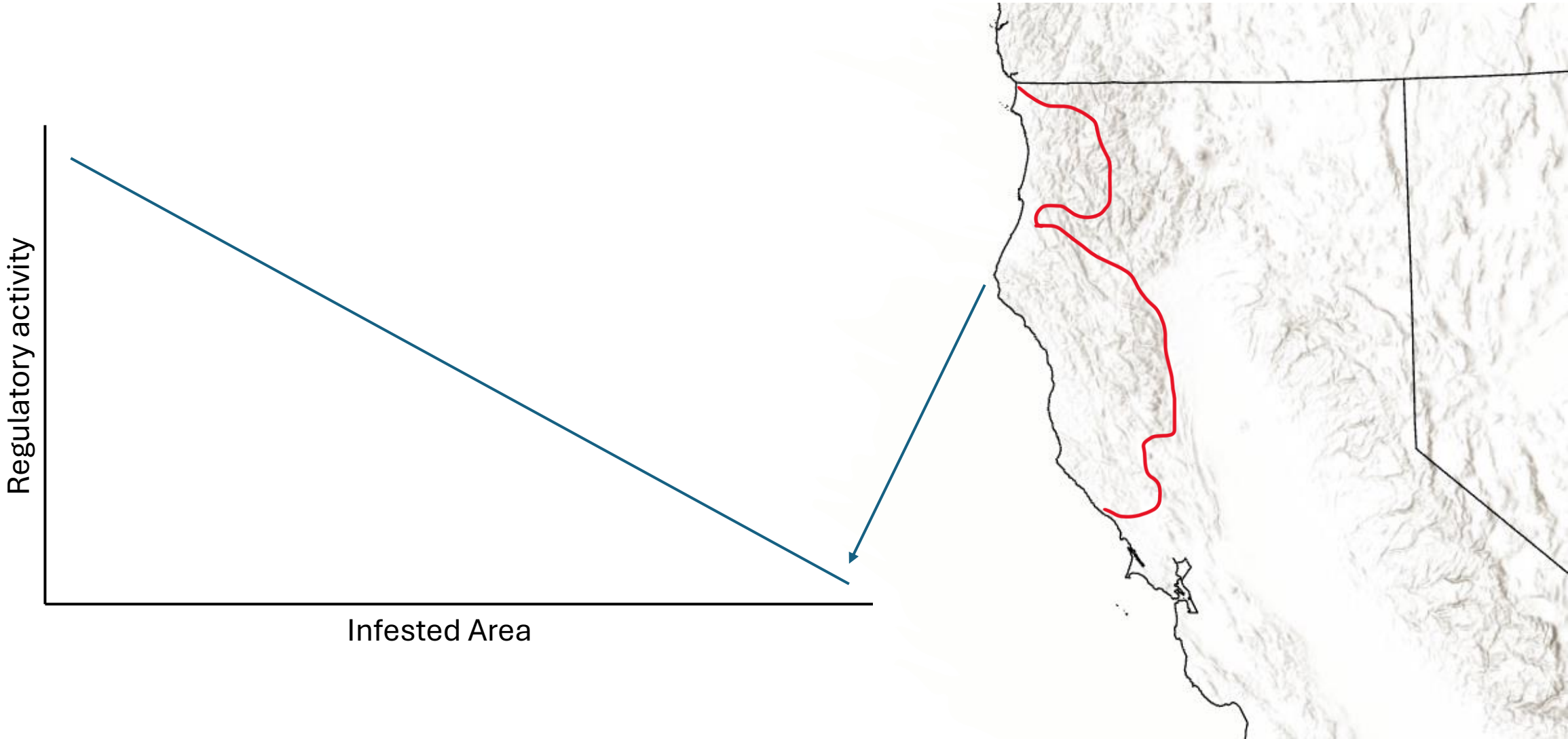

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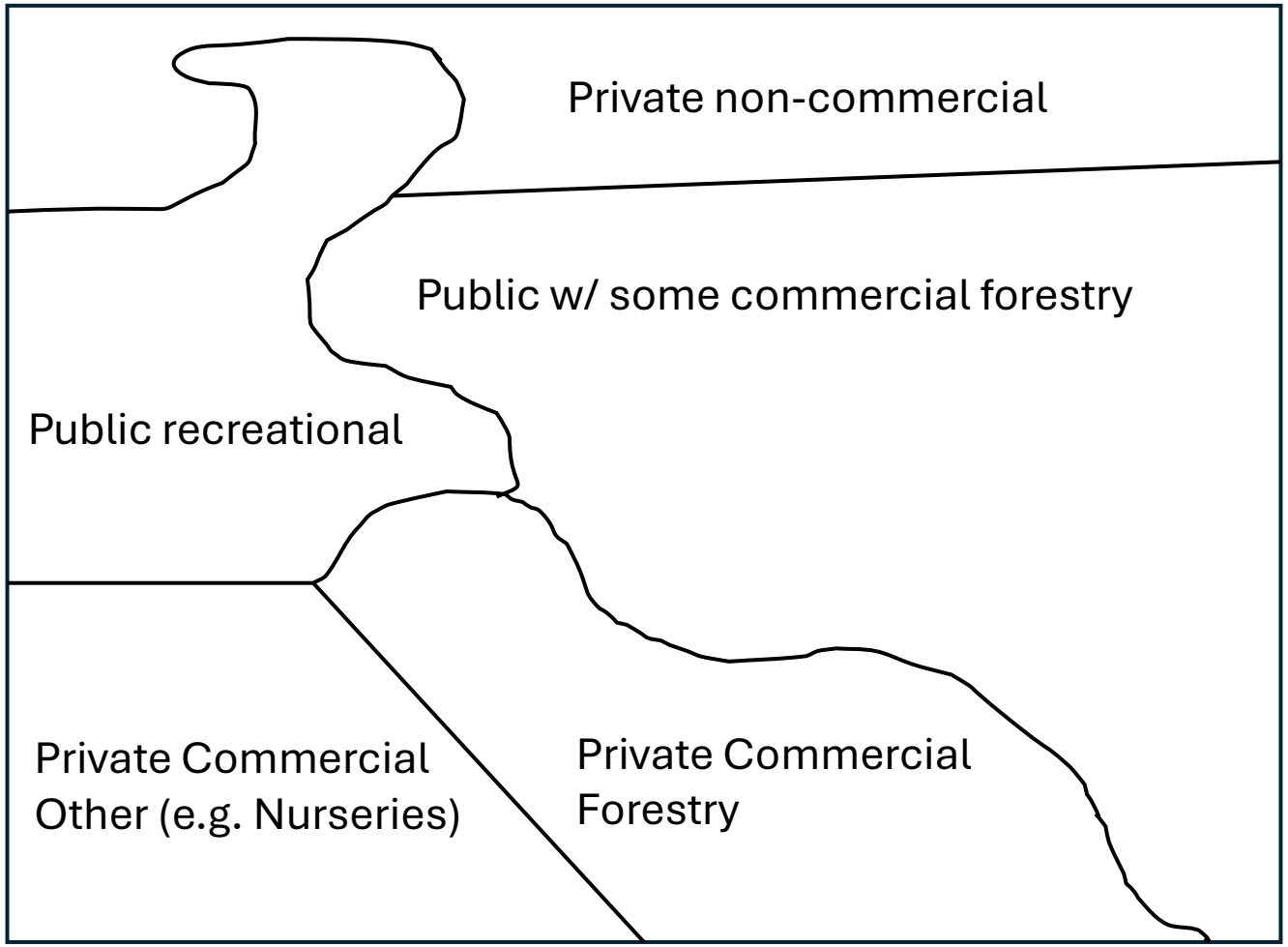

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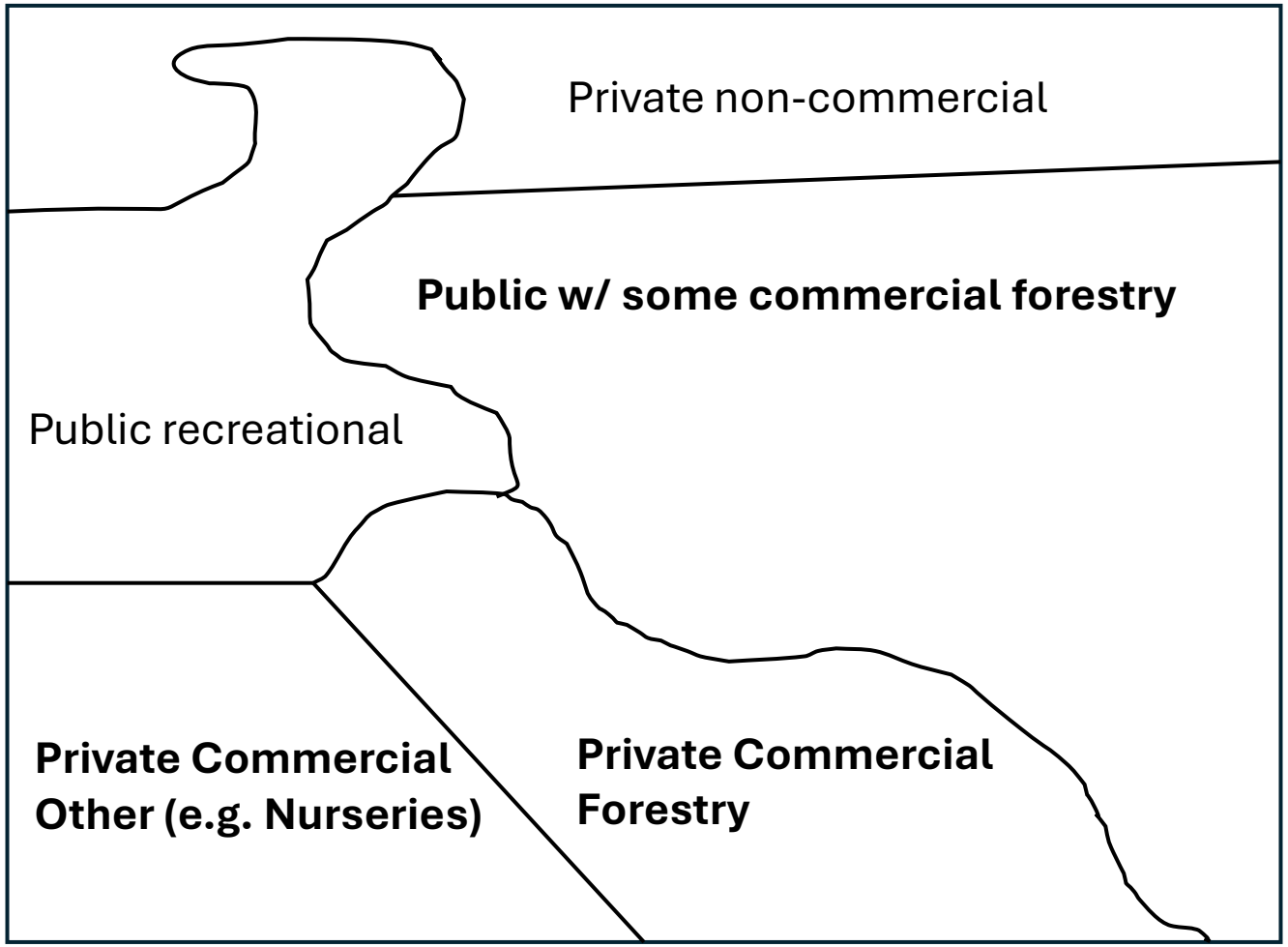

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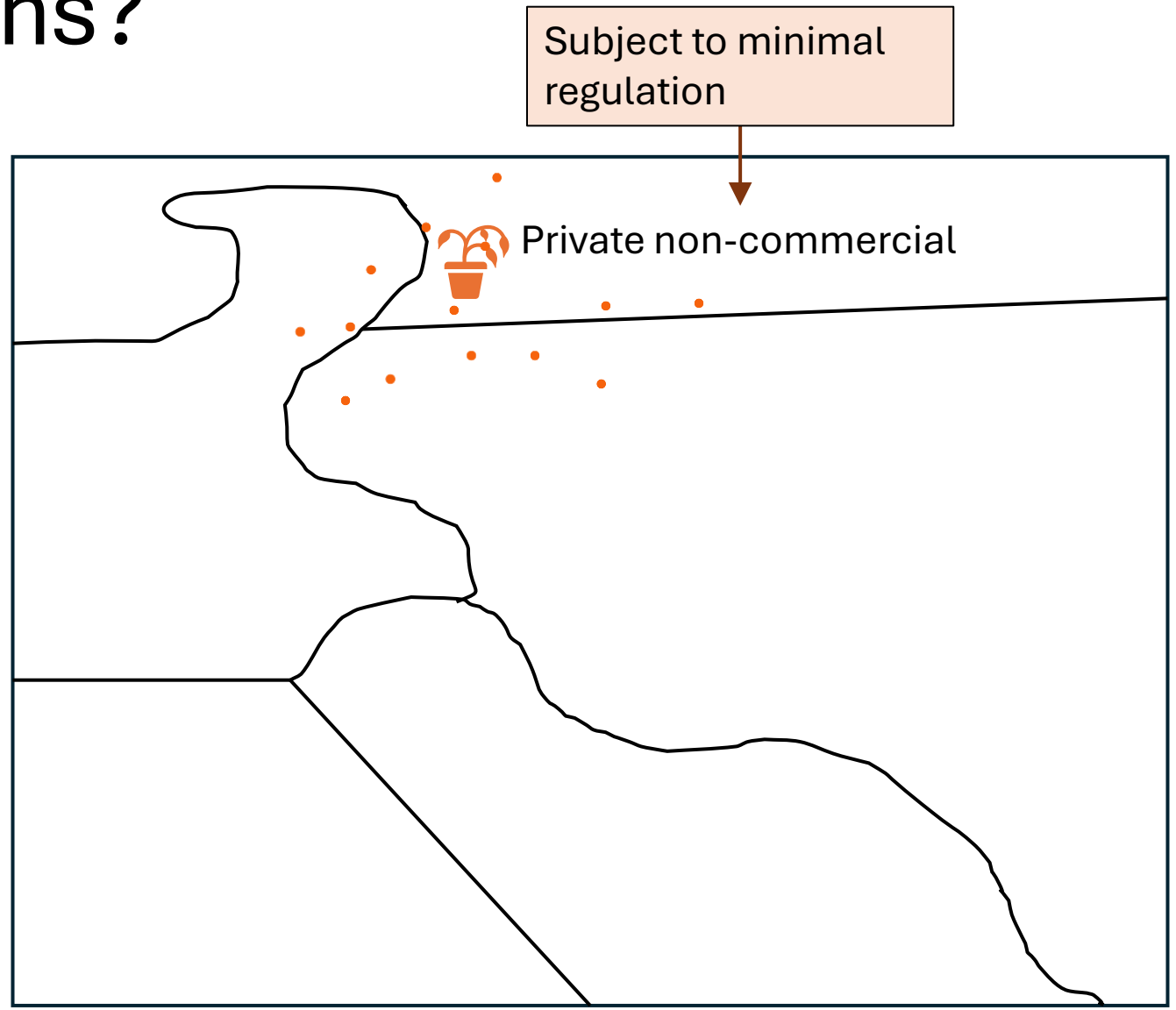

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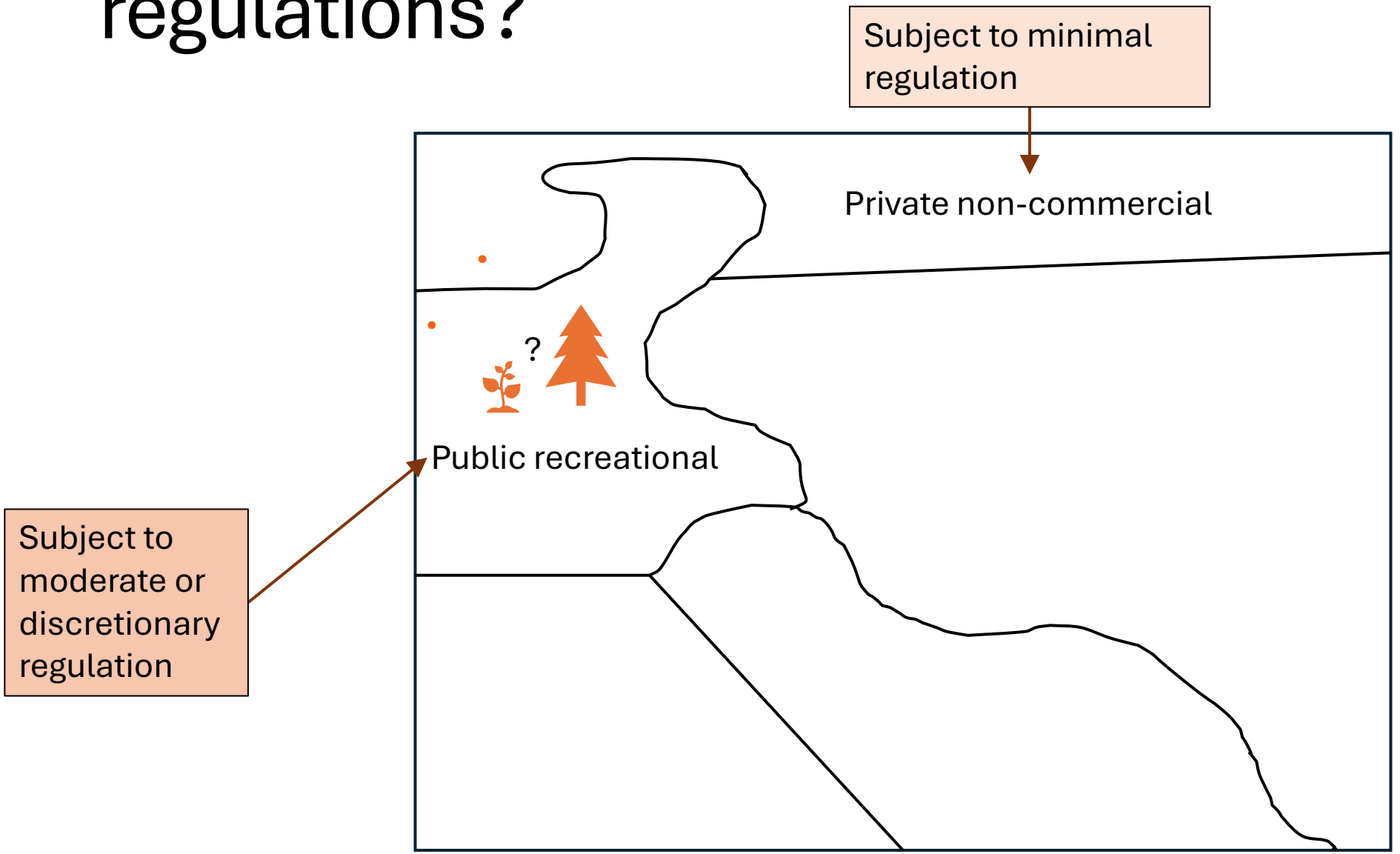

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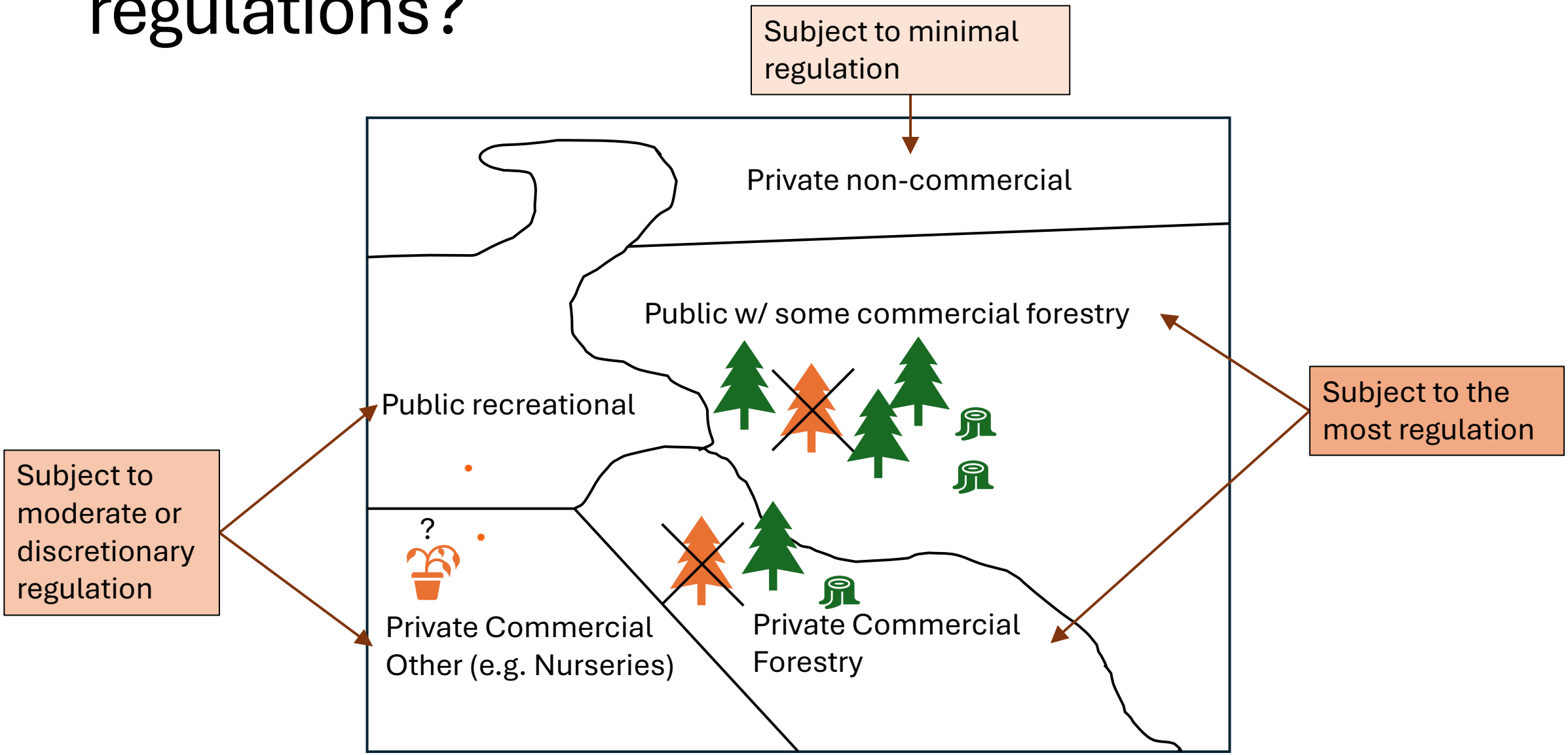


Regulations Pt 4: Different regulatory models

Regulating Practice

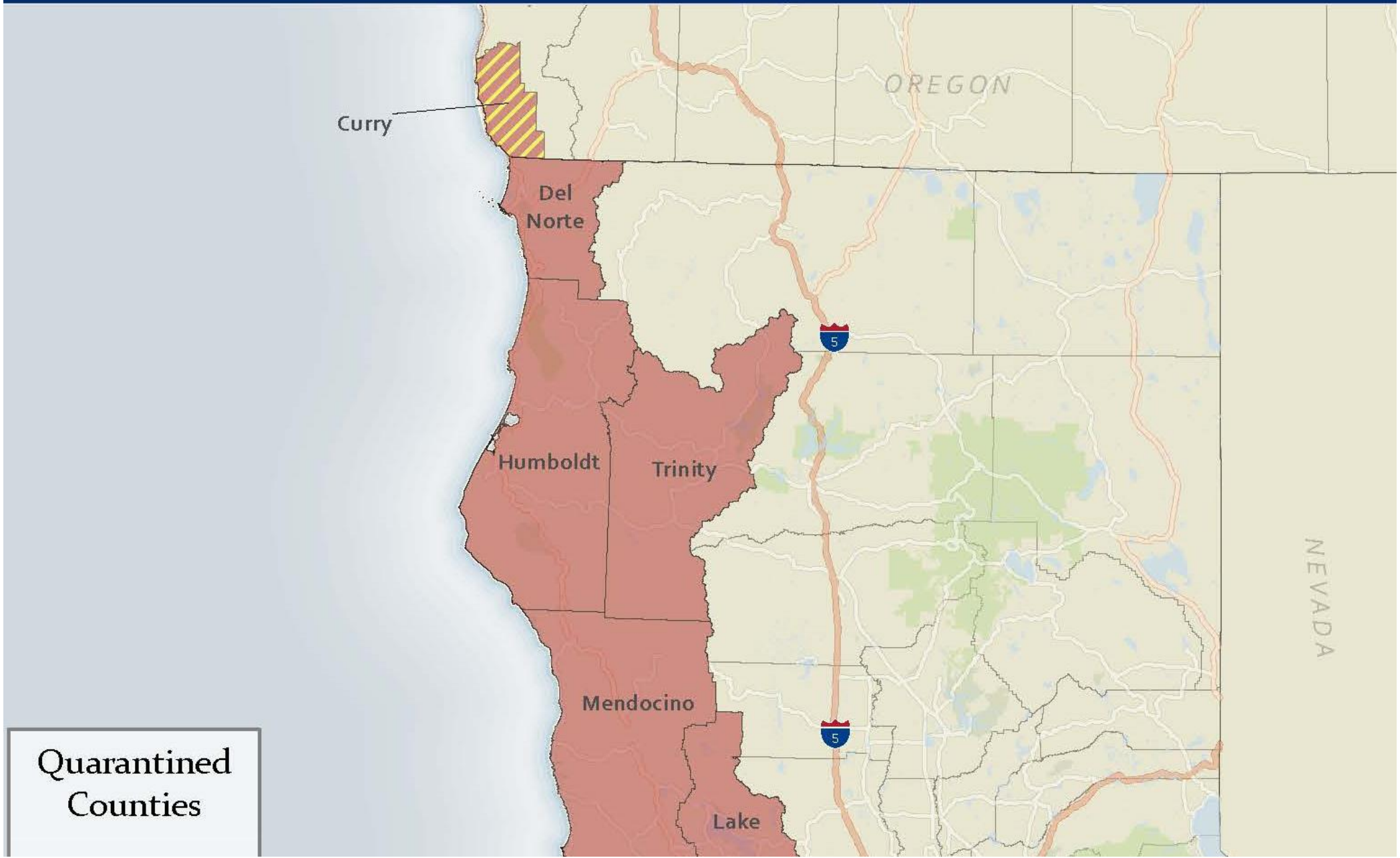
- Preventing circumstances that give rise to pests/pathogens
- Holistic disease prevention
- Requires more personnel
- Difficult to finance enforcement and compliance

Regulating Products

- Inspecting products for specific pests/pathogens
- Only screens for specific diseases
- Less labor intensive
- Generally cheaper to destroy products than to overhaul production system

USDA Animal and Plant Health Inspection Service
U.S. DEPARTMENT OF AGRICULTURE

FEDERAL QUARANTINE STATUS
Phytophthora ramorum



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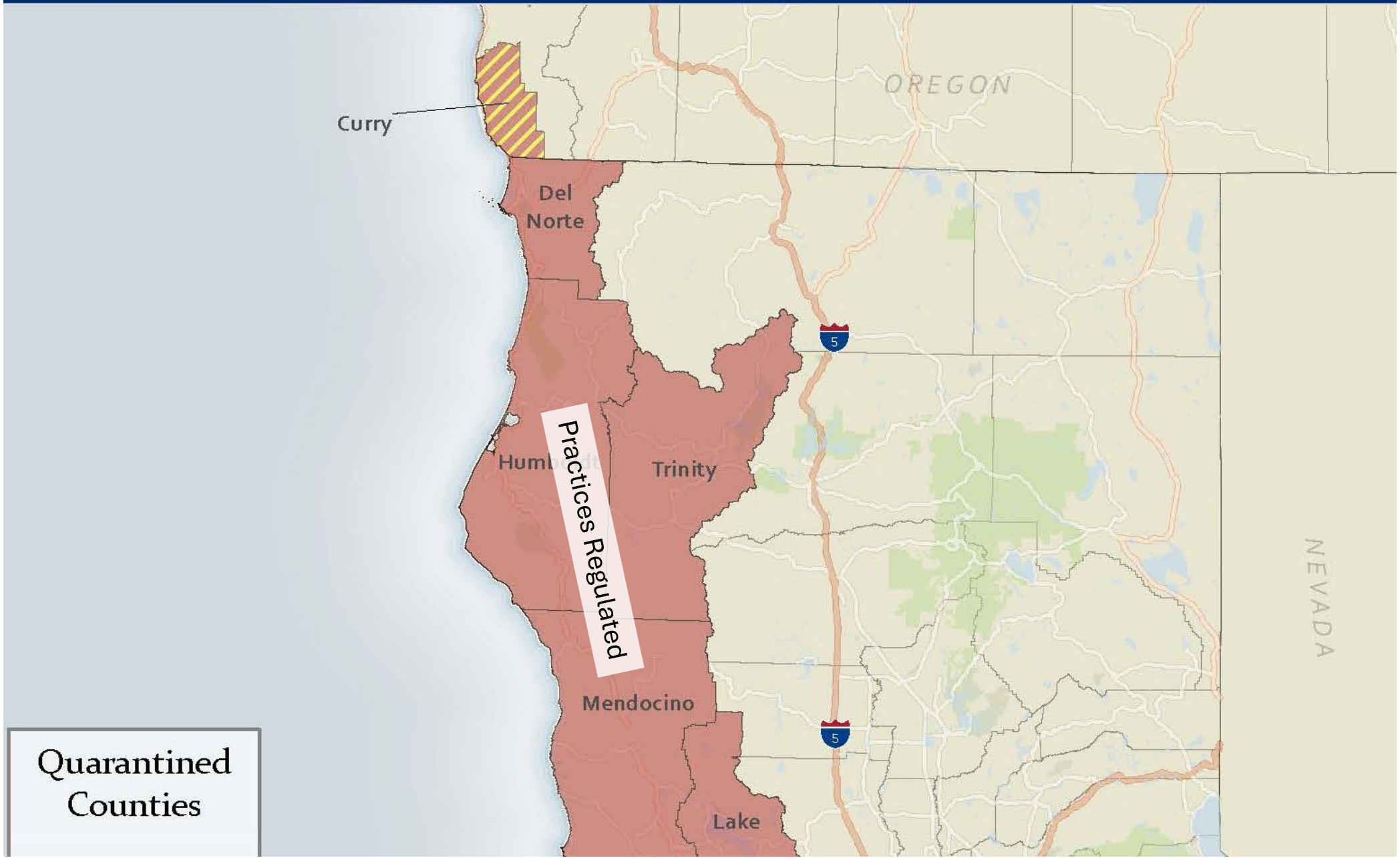

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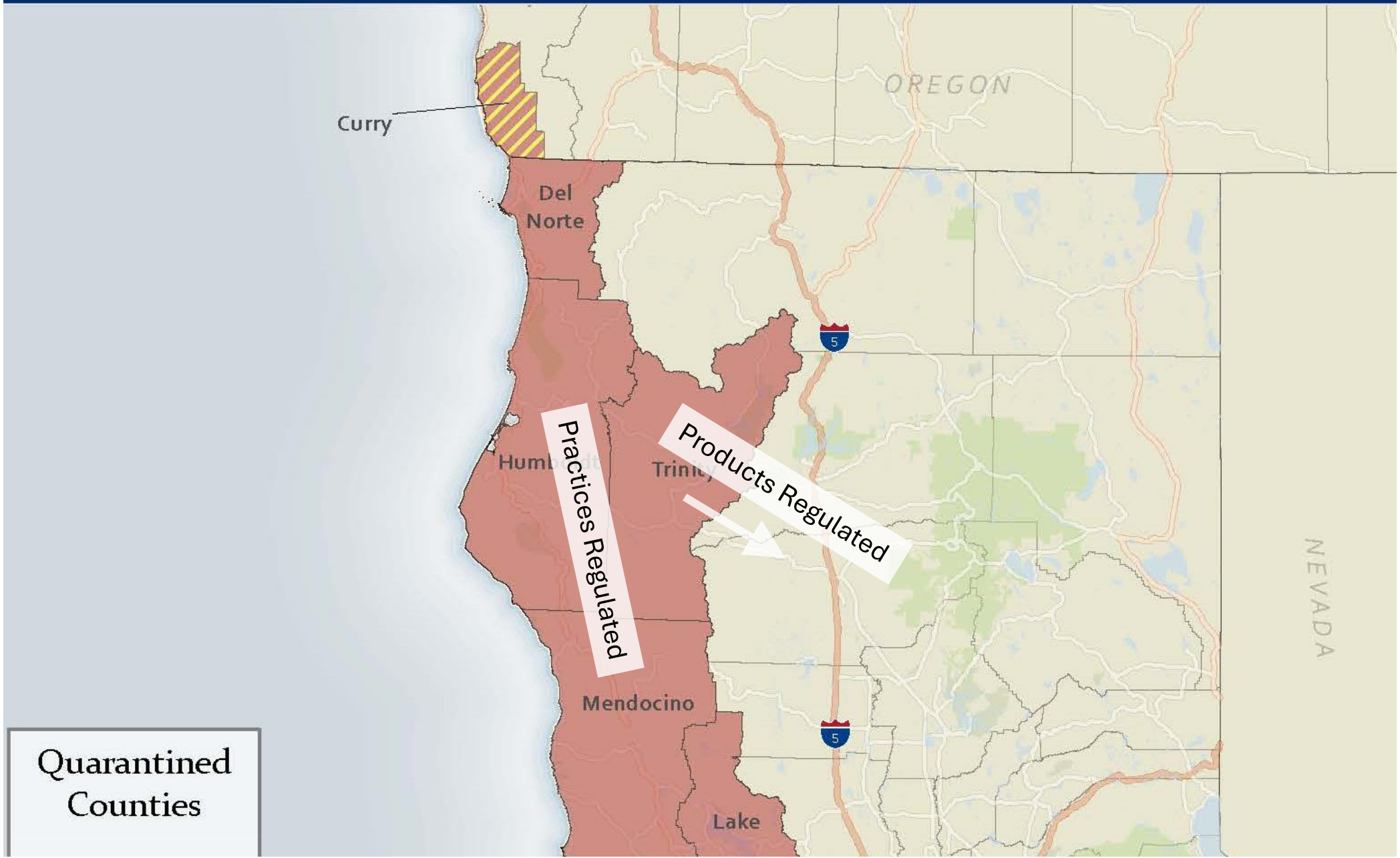


Phytosanitary Practices for Nurseries

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.*

Clean Production Benches. Photo credit: Diana Benner

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 .

About AIR

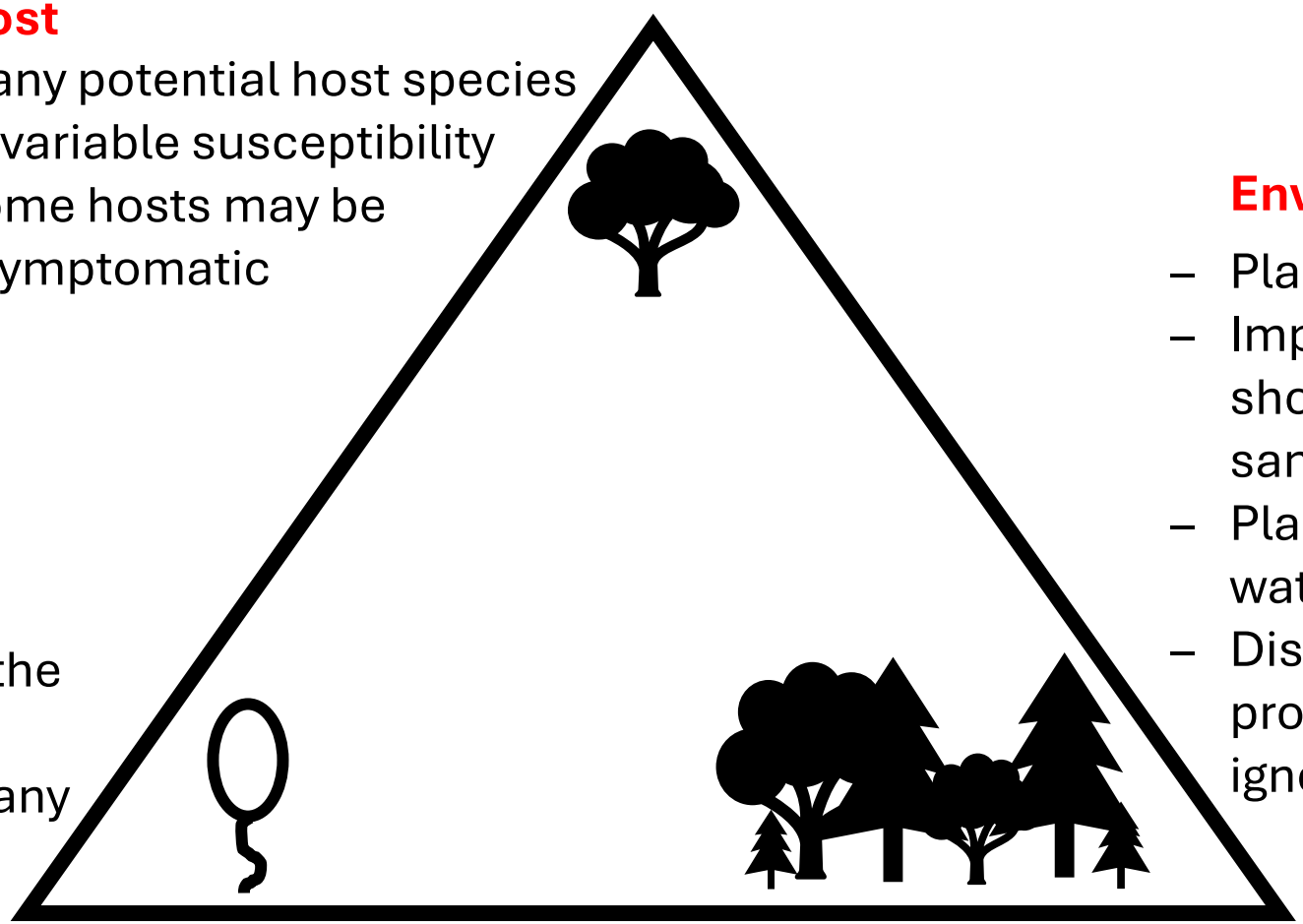
- Program Basics
- Participating Nurseries
- AIR Team
- Partners

How Can We Avoid These Issues?

Good Phytosanitary Practices!

Host

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



Pathogen

- Often imported from elsewhere, not native to the North Coast
- Often generalists with many host species

Environment

- Plants often close together
- Improper or lack of tool, shoe, pot, tire, and soil sanitation
- Plants may be in standing water due to poor drainage
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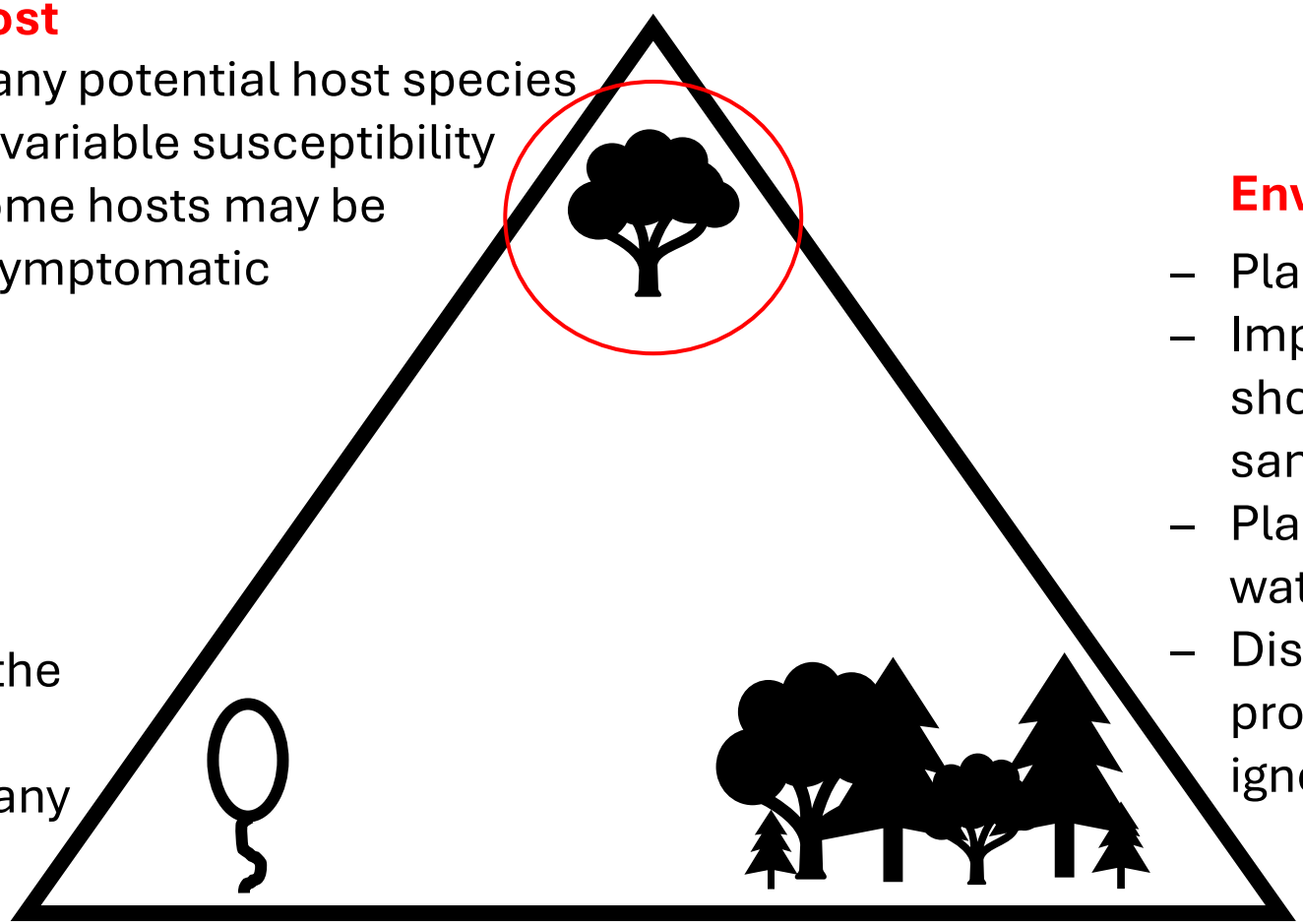

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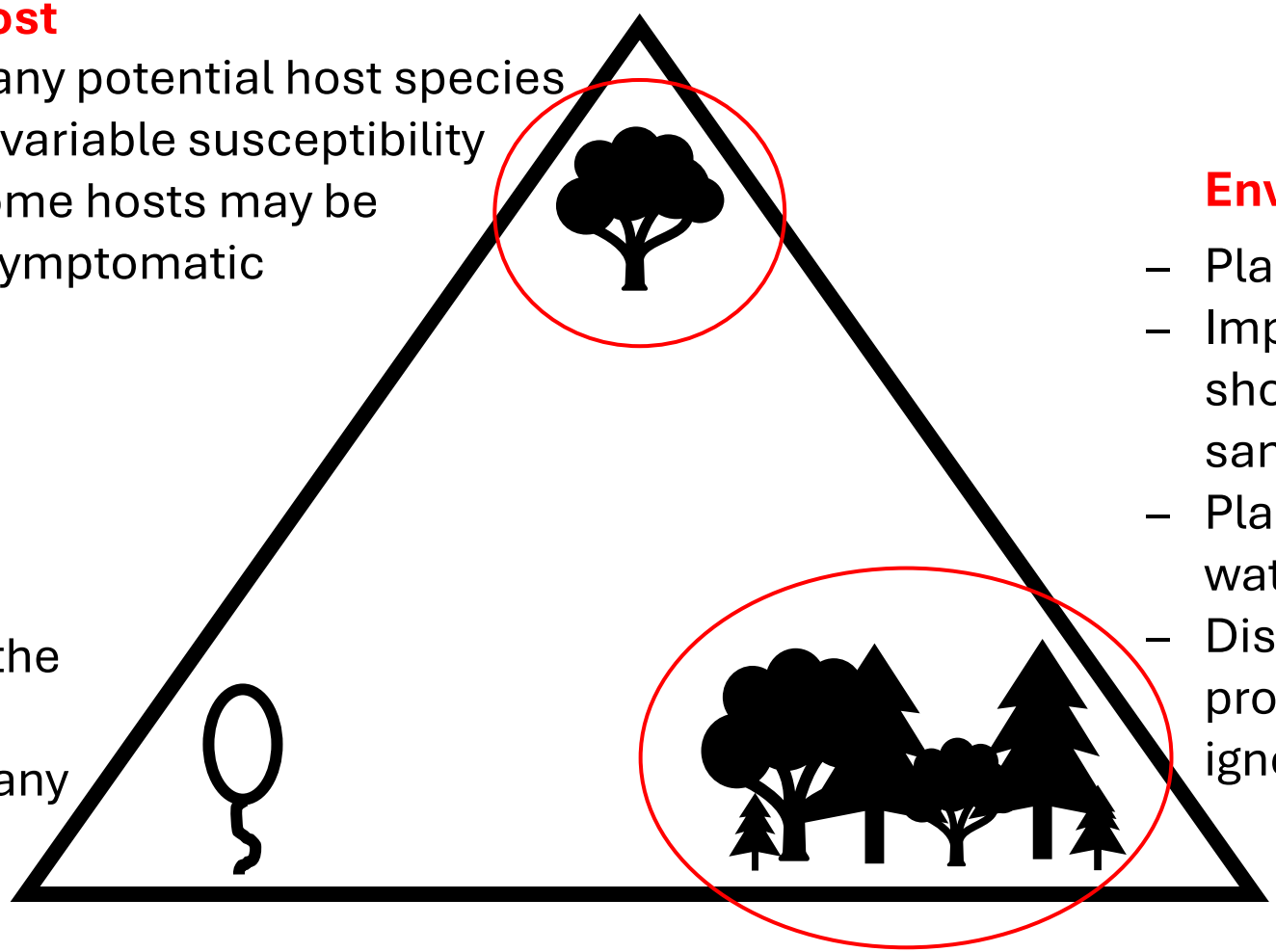
- Some hosts may be asymptomatic



Pathogen

- Often imported from elsewhere, not native to the North Coast
- Often generalists with many host species

Environment

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

How Can We Avoid These Issues?

Good Phytosanitary Practices!

Host

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- Some hosts may be asymptomatic

Pathogen

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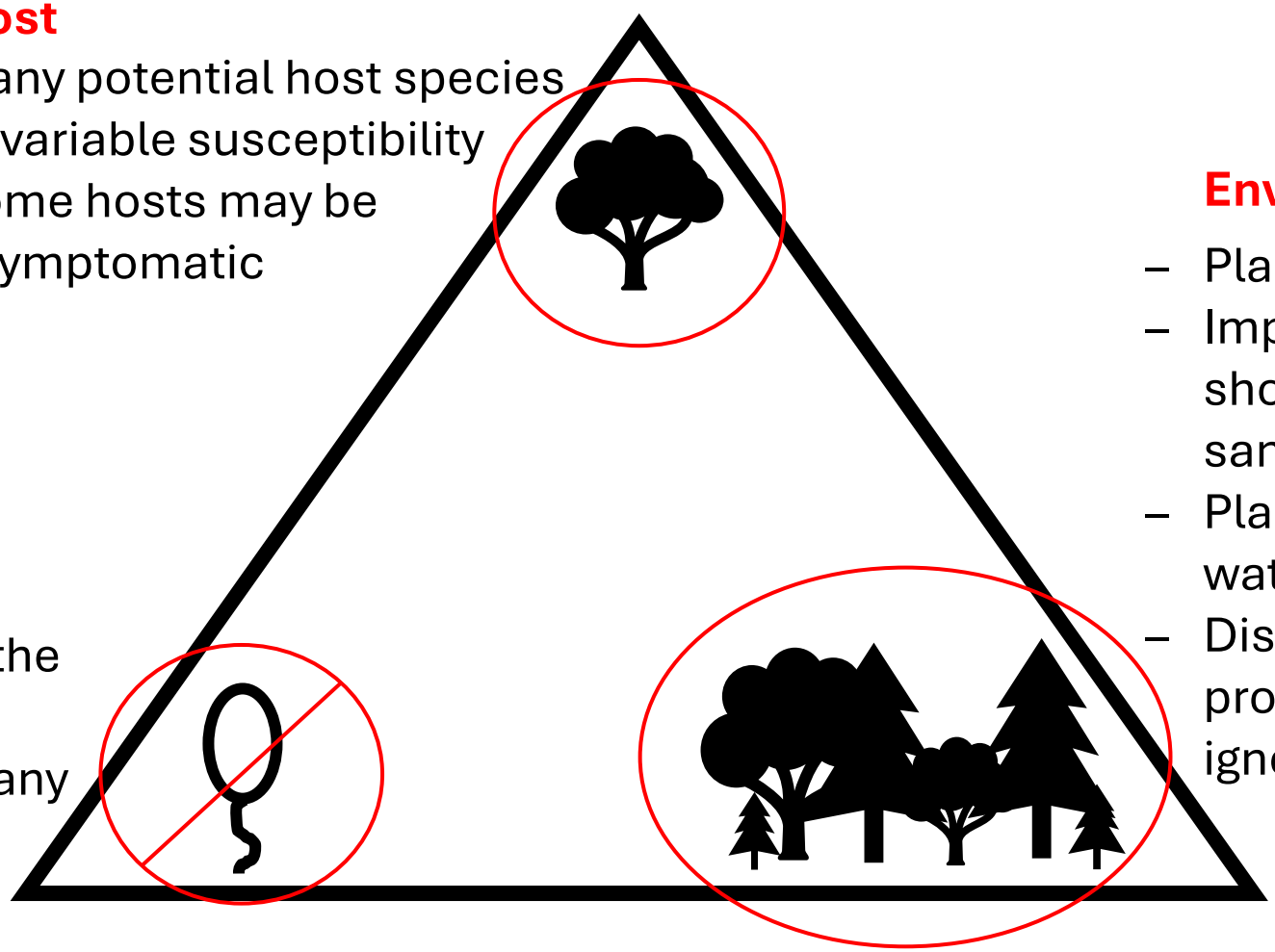

Environment

- Plants often close together
- Improper or lack of tool, shoe, pot, tire, and soil sanitation
- Plants may be in standing water due to poor drainage
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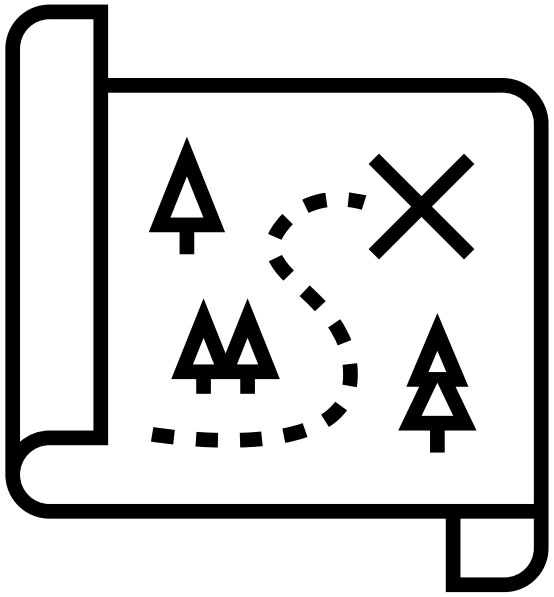
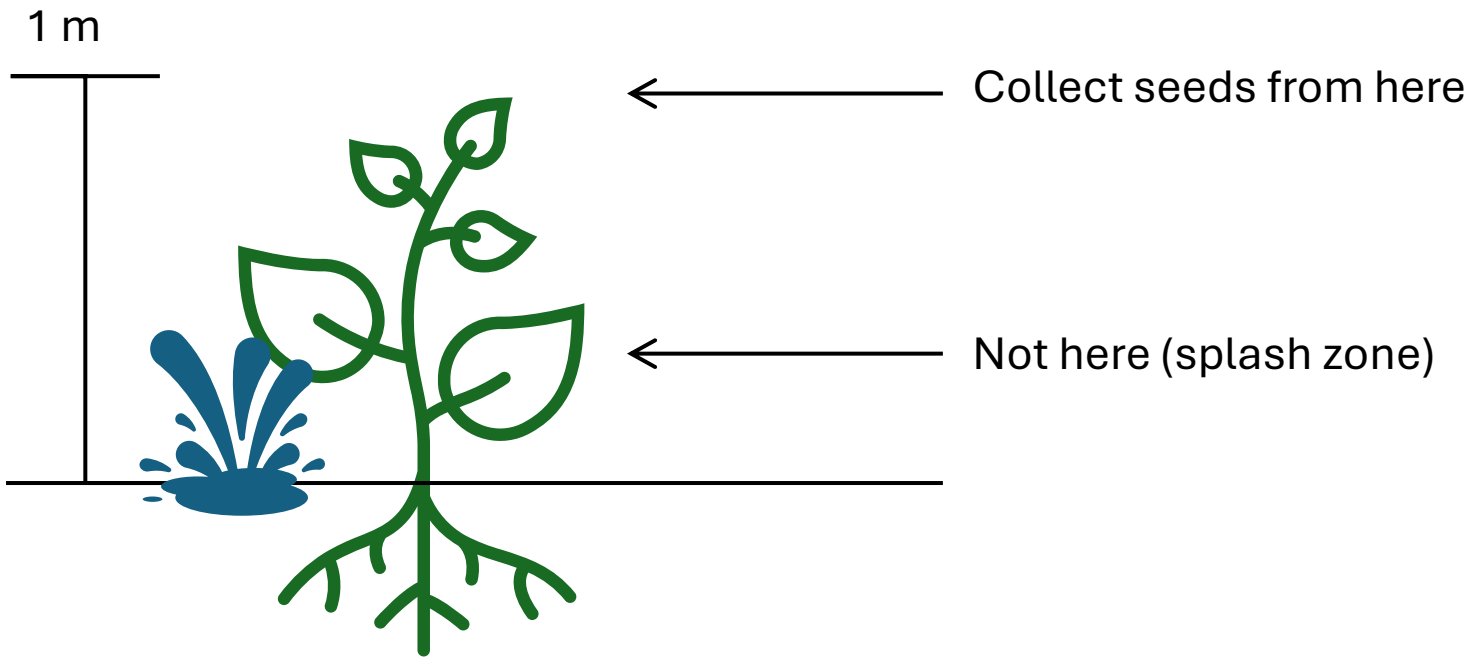
Host-Related BMPs

Where to Find Additional Host BMPs:

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



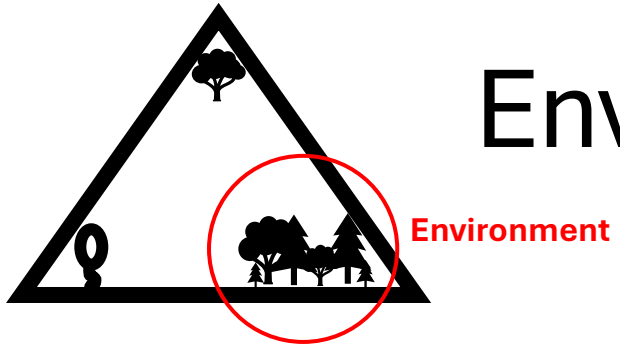


Collect from places *without*:

- 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

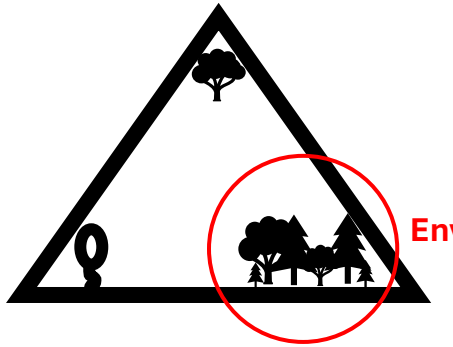
Pot Sanitation

Chemical

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

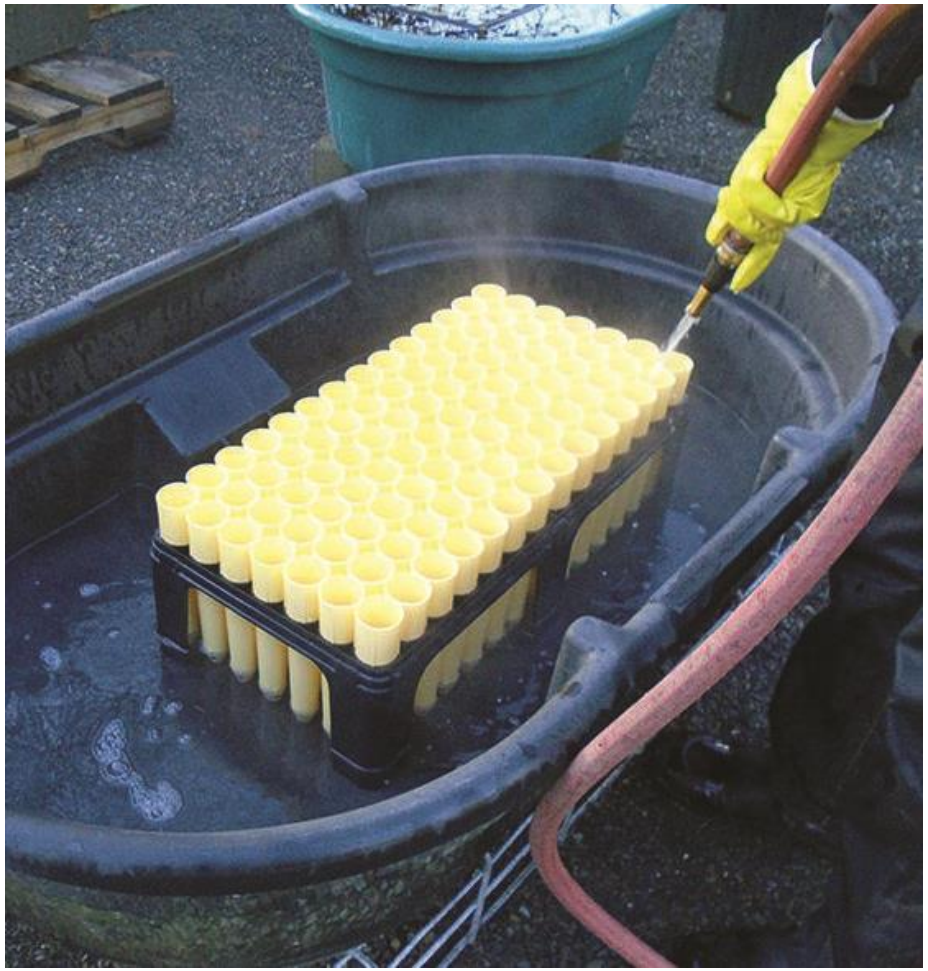
Heat

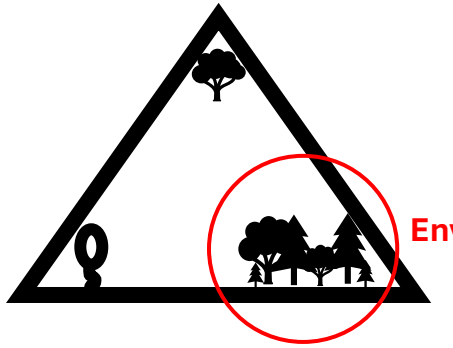
- Steam, hot water, or solar
- Moisture matters!
- Wet material: 140 °F for 30 min
- Dry material: 160 °F for 30 min
- Requires thermometers to ensure adequate heating of all material



Environment-Related BMPs

Pot Sanitation





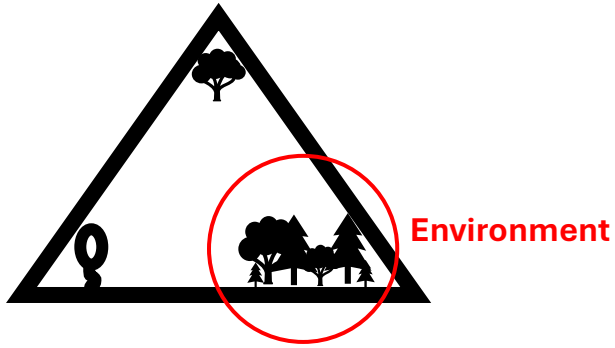
Environment-Related BMPs

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?

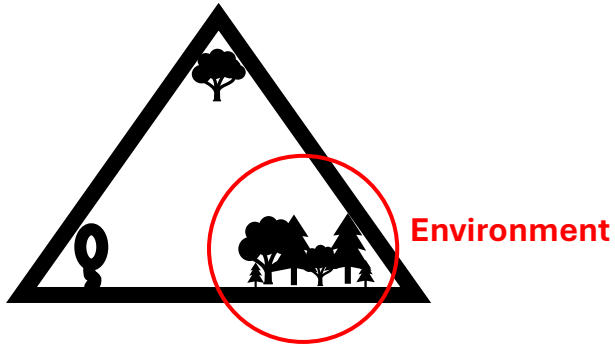
NORS-DUC researcher living his best life →



Environment-Related BMPs

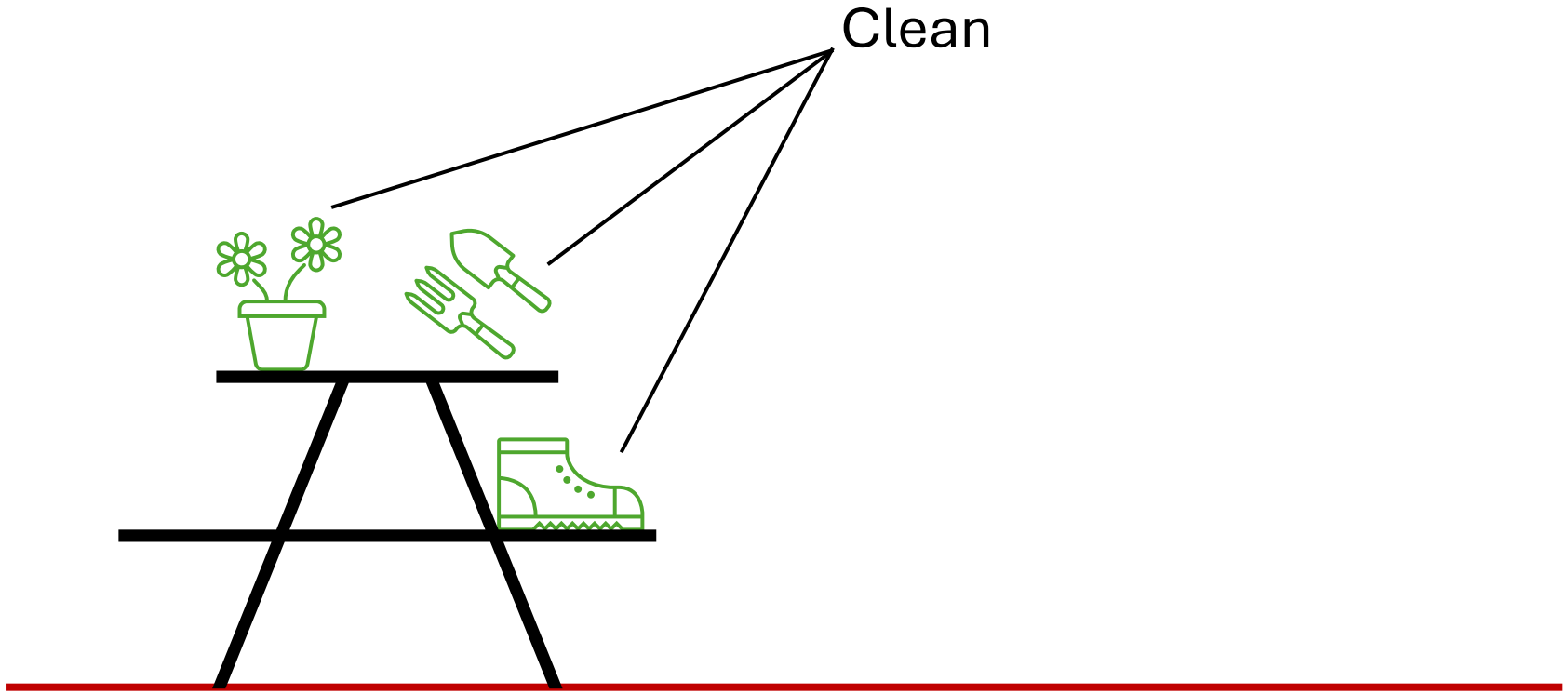
Tool and Shoe Sanitation

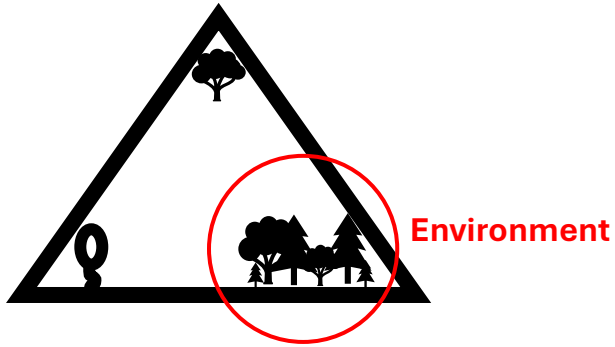
- Same principals as pot sanitation
- More heat = less time
- ≥ 70% ethanol and isopropanol also effective
- Spray bottles are your friend
- Footbaths or shoe cleaning stations between clean and potentially contaminated areas



Environment-Related BMPs

General Production





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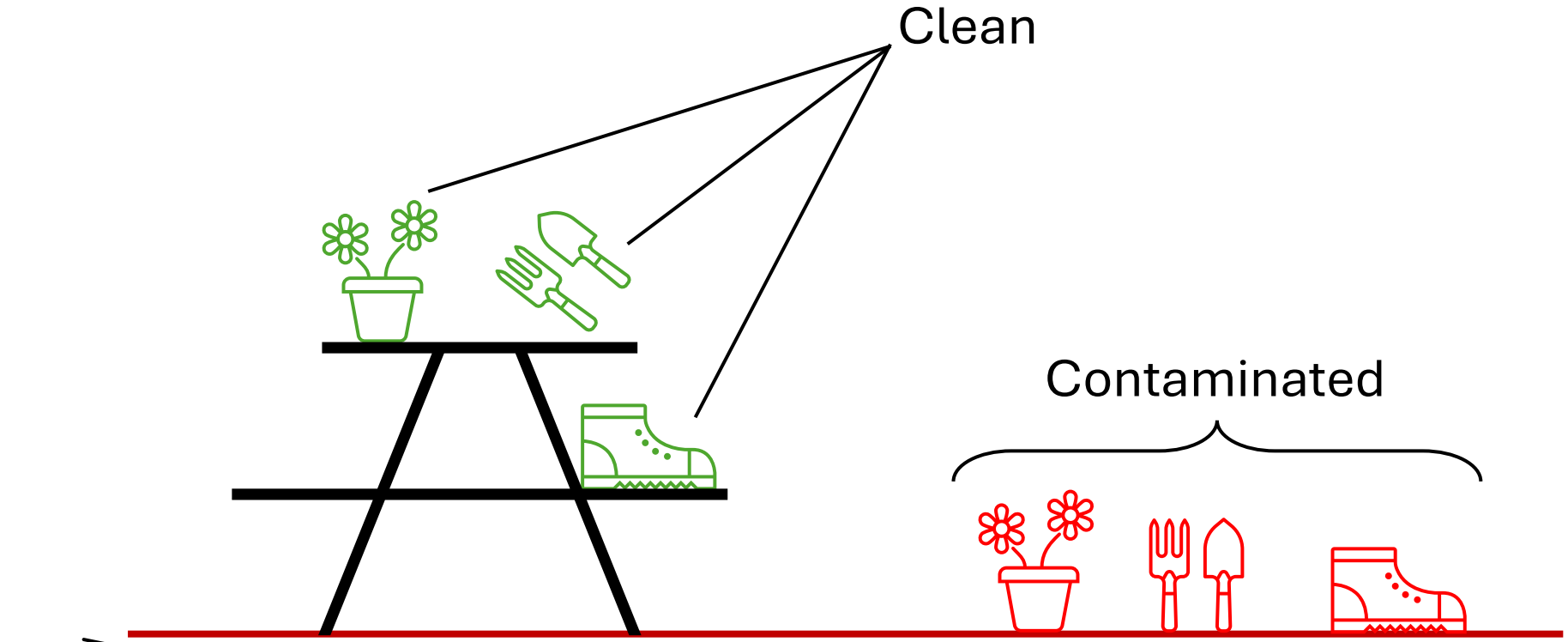
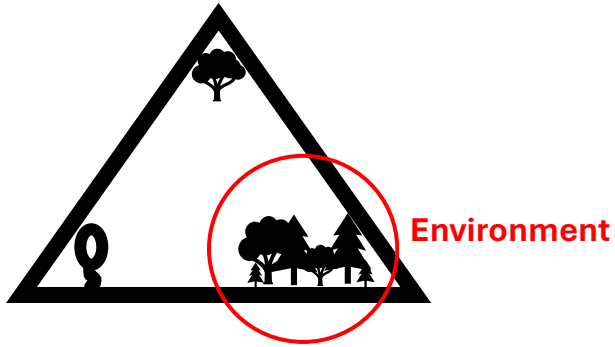
General Production



“The ground is lava”



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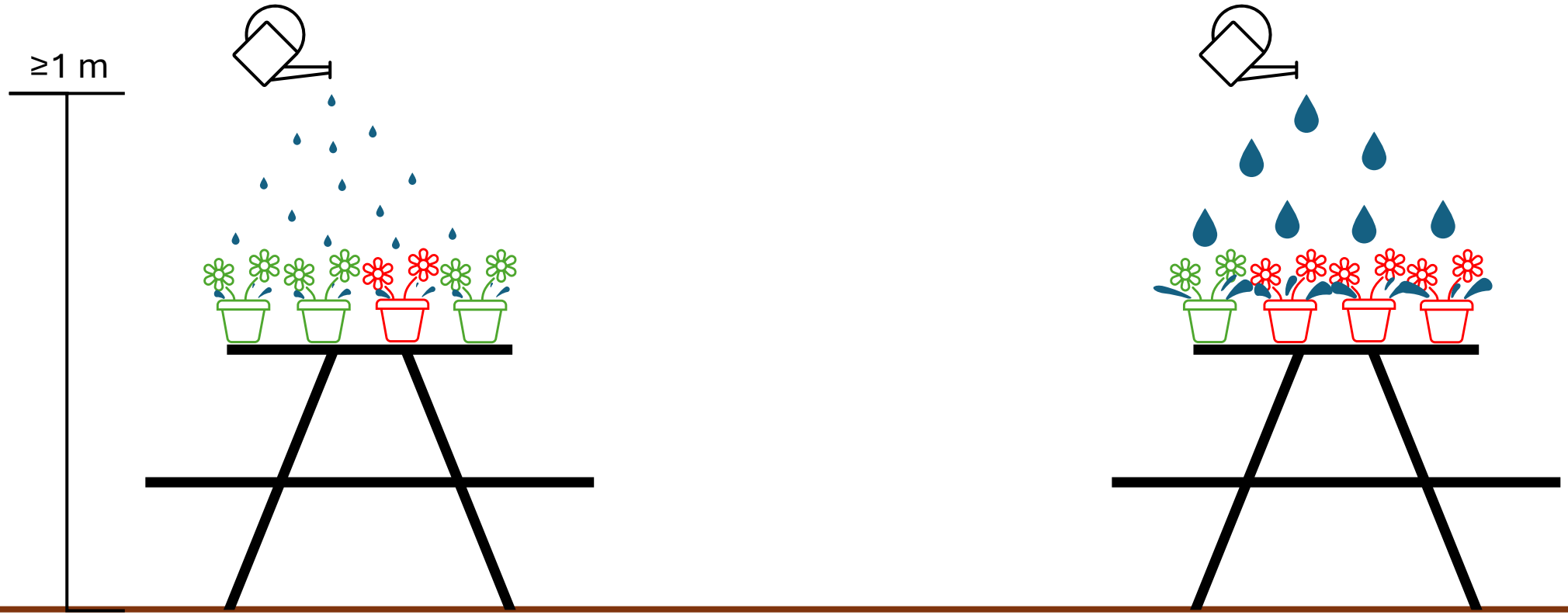

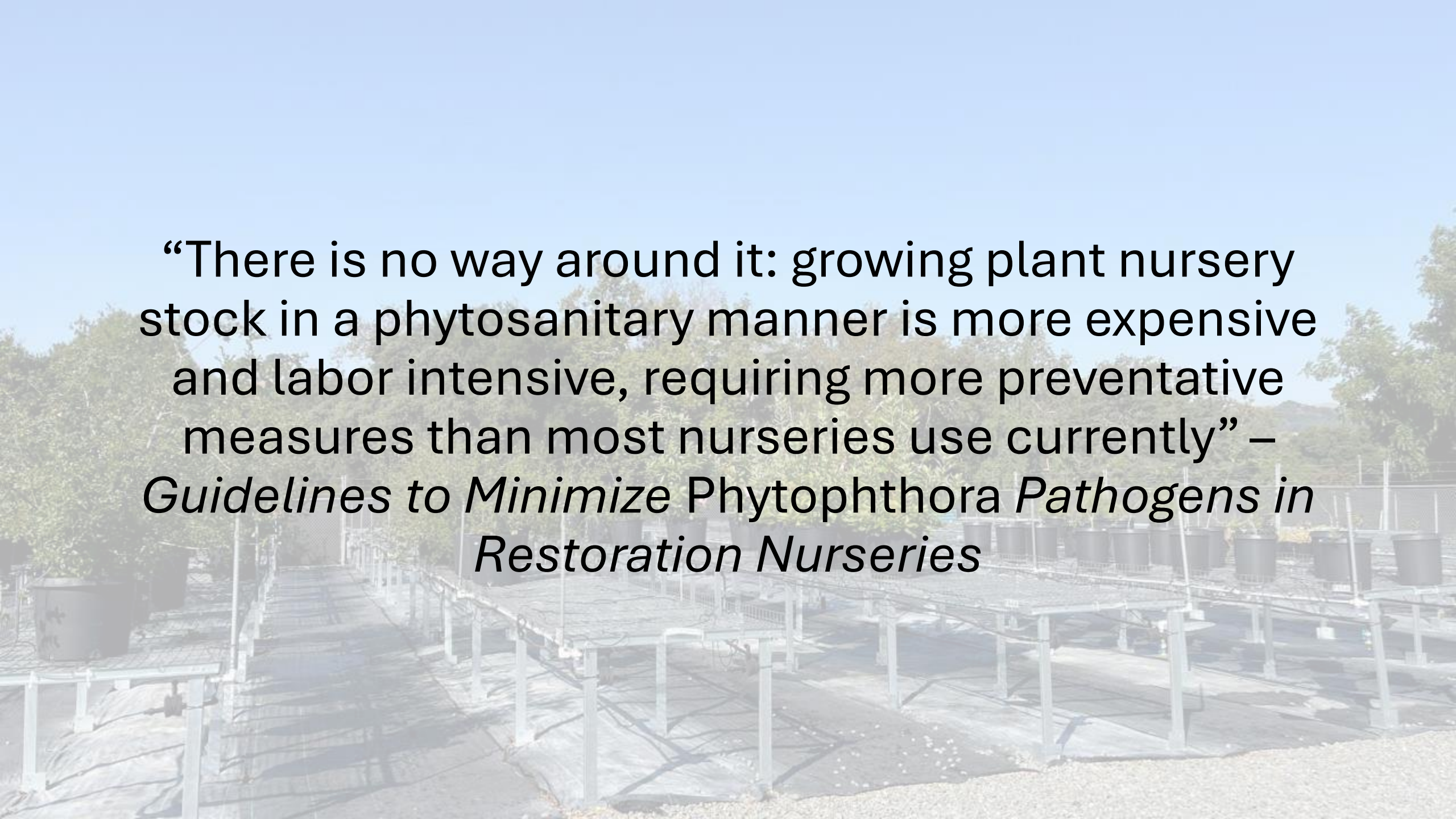

“There is no way around it: growing plant nursery stock in a phytosanitary manner is more expensive and labor intensive, requiring more preventative measures than most nurseries use currently” – *Guidelines to Minimize* Phytophthora *Pathogens in Restoration Nurseries*

Possible Avenues for Funding

APHIS

- Plant Pest and Disease Management and Disaster Prevention Program

PPA 7721 Goal Areas

1. Plant pest and disease survey or analysis
2. Domestic interstate inspection
3. Pest ID and diagnostic technology
4. Protecting nursery production
5. Public outreach and education
6. Pest mitigation and rapid response

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Goal Area 6 Objectives

Goal 6: Enhance mitigation capabilities and rapid response	**Develop or adapt new control technologies, tools, and treatments for use in plant health emergencies.** **Improve the knowledge base, response options and capabilities prior to the onset of a plant health emergency.** **Support the use of existing tools and initial response protocols for the overarching goals of containment, control, and/or eradication of plant pests.**

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CNPS

- Some chapters give small grants to their own native plant nursery

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Lobbying CDFA to provide a nursery grant program?

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

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?

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/