



United States Department of Agriculture
Animal and Plant Health Inspection Service
Plant Protection and Quarantine



**Trace Forward Protocol
For
Nurseries that Received Plant Material Shipped from a Confirmed
Phytophthora ramorum infested nursery**

**6 June 2008
Version 2.1**

Purpose

The purpose of this protocol is to establish a set of procedures that are to be used to determine if a nursery that received plants from a *Phytophthora ramorum* confirmed positive nursery has infected plants in their inventory, and thus has become infested themselves. *P. ramorum* is the plant pathogen that causes sudden oak death, ramorum blight, and ramorum die-back. By following the procedures in this protocol, we can ensure a consistent, science and risk based response to detections of *P. ramorum* in commercial nursery stock. For more information on this pathogen please visit the USDA, APHIS, PPQ web site at: http://www.aphis.usda.gov/plant_health/plant_pest_info/pram

Definitions

- Associated plants:** Associated plants are those reported found naturally infected and from which *P. ramorum* has been cultured and/or detected using PCR (Polymerase Chain Reaction). For each of these, traditional Koch's postulates have not yet been completed or documented and reviewed. See Appendix A
- Block:** Within a nursery, this is a contiguous block of HAP. The block will be considered contiguous until there is a 2 meter break of either no plants or no HAP.
- Confirmed Positive:** The test result on a presumptive positive that *P. ramorum* is present based on DNA testing or culture morphology. This confirmation would be conducted by APHIS in the case of PASS samples or by the provisionally approved lab or diagnosticians with identification authority in the case of non-PASS samples.
- Cull Pile:** An area where discarded plant material is deposited. This area may also be known as a waste pile.
- Destruction block:** Block of plants to be destroyed. For precise definitions of destruction block see the Confirmed Nursery Protocol for

Wholesale and Production nurseries, and the Confirmed Nursery Protocol for Retail Nurseries.

Destruction radius:	Block of plants to be destroyed. Within a nursery, for purposes of the retail protocol , the destruction radius is defined as all <i>P. ramorum</i> infected HAP and all other HAP within 2 meters of any infected HAP.
HAP:	Host and associated host plants listed on the official APHIS List of Regulated Hosts and Plants Associated with <i>Phytophthora ramorum</i> .
High Priority Target Plants:	These are any HAP which originated in the destruction block at the infested (source) nursery. These plants are to be identified using the best available information and to the lowest available taxonomy, (for example, if high priority target plants can be identified to cultivar, then trace forward activities may be conducted at the cultivar level). Identify all domestic and international HAP shipments within the 12 months prior to the first positive detection of <i>P. ramorum</i> for only the infected plant species and for the five high risk host genera (<i>Rhododendron</i> , <i>Camellia</i> , <i>Viburnum</i> , <i>Pieris</i> and <i>Kalmia</i>)
Host plants:	Naturally infected plants verified with completion, documentation, review and acceptance of traditional Koch's postulates and listed in the "APHIS List of Regulated Hosts and Plants Associated with <i>Phytophthora ramorum</i> ". (Also see: "Associated Plants")
Infected plants:	Plants officially confirmed as being infected with <i>P. ramorum</i> , based on the use of APHIS approved diagnostics.
Medium Priority Target Plants:	Any HAP located in an infested nursery which did not originate in the destruction block.
Nursery/Facility:	Any location where nursery stock is grown, propagated, stored, or sold; or any location from which nursery stock is distributed. Locations that grow trees to be sold without roots (i.e. Christmas trees) and locations where such trees are stored or distributed are considered to be nurseries.
Quarantine Block:	Area identified as a 10 meter radius from the destruction block (see Appendix B) designed to determine if <i>P. ramorum</i> has spread beyond the destruction block.

Quarantine radius:	Block of plants to be quarantined. Within a nursery for purposes of the retail protocol this is an area identified as a 2 meter radius beyond the destruction radius (see Appendix C) designed to determine if <i>P. ramorum</i> has spread beyond the destruction radius.
PASS (Potentially Actionable Suspect Sample):	A presumptive positive <i>P. ramorum</i> sample diagnosed or identified by a provisionally approved laboratory or diagnostician with identification authority that would require confirmatory testing by an official APHIS Laboratory due to the nature of the plant sampled and the necessity for Federal confirmation. (For more information see: “PASS System Policy” at: http://www.aphis.usda.gov/plant_health/plant_pest_info/pram/)
Retail nursery:	A nursery whose business is the sale of plants to the end user, typically a home owner.
Suspected infected plants:	These are plants with visible symptoms of <i>P. ramorum</i> infection; and/or HAP that are a part of an infested block or derived from an infested block or quarantine block; and/or plants that have tested positive using PCR or culturing, but have not been confirmed positive for <i>P. ramorum</i> by APHIS.
Trace Back (TB) Plants:	All plants of the same taxon (such as genus, species, hybrid, variety, or cultivar) regardless of size, location or lot, back to the original propagation source if still existing.
Trace Back (TB) Site:	Any location that shipped potentially infected plants to a confirmed infested nursery, residence or commercial landscape.
Trace Forward (TF) Plants:	Plants identified on a trace forward list as being potentially infected with <i>P. ramorum</i> .
Trace Forward (TF) Site:	Any location that received potentially infected plants from a confirmed infested source nursery; including residential or commercial landscapes.

Before inspection

1. Plan an inspection without delay. However, an inspection must be conducted when favorable climatic conditions, pathogen infectivity, and host susceptibility share an optimum time for disease development and symptoms are likely to be expressed. If conditions are not suitable for disease development when the initial inspection is

conducted, an additional inspection must be conducted when favorable climatic conditions are present.

2. For Federal inspectors, notify state officials of your plans to inspect.
3. Coordinate visit with State inspector.
4. Federal and State or County inspectors should contact the nursery owners/managers prior to the visit to determine how many plants are still in stock and to arrange for the inspection. This nursery contact would normally occur within 24 hours of the expected arrival time for the TB inspection.
5. If you are unable to visit the nursery within one day of your contact with the nursery owner/manager, send a PPQ form 523, an Emergency Action Notification (EAN) by fax to them and request that they sign and return it to you by fax.

Survey/Inspection Procedure

1. Identify yourself and agency to the nursery/facility owner/manager.
2. Explain to the nursery/facility owner/manager the purpose of your visit.
3. Obtain copies of the shipping documents that relate to the trace forward plants received from a confirmed *P. ramorum* infested nursery. Also obtain copies of those documents associated with trace forward plants that came from the confirmed positive nursery that have been shipped by the trace forward nursery to other nurseries or retail facilities.
4. Determine the presence or absence of any of the trace forward High Priority Target Plants and Medium Priority Target Plants at the trace forward site.
 - If the trace forward nursery received high priority target plants from the infested source nursery during the past 12 months, a trace forward investigation must be conducted, even if there is no longer any high priority target plants present on the trace forward nursery. If records are available, use them to determine if or what other hosts may have come in contact with the trace forward plants, and where in the nursery that contact occurred.
 - If the trace forward nursery received in the previous 12 months only medium priority target plants from the infested source nursery a trace forward investigation must be conducted if the plants are still present on the nursery.
 - If the trace forward nursery received in the previous 12 months only medium priority target plants from the infested source nursery a trace forward investigation may be conducted or the investigation may be deferred and the nursery placed on the target list for the next cycle of nursery surveys for *P. ramorum*, if the plants are no longer present on the nursery.
5. Ask owner/manager to fill out questionnaire (attached, Exhibit D), or complete with their input.
6. Complete an Emergency Action Notification (EAN, PPQ form 523) to place a hold on all the high and medium priority target trace forward plants from the infested (source)

nursery and other HAP, products or articles that present a risk of spreading *P. ramorum*. The *P. ramorum* host list is available at the APHIS *P. ramorum* Web site: http://www.aphis.usda.gov/plant_health/plant_pest_info/pram

Use this language in Section 16 of the PPQ 523 – Action Required:

- All plants of the following listed species received from [INSERT Name of Nursery] during the period from [INSERT dates, one year prior to current date. Example: March 1, 2007 to February 28, 2008] are prohibited from movement pending further notification by USDA, APHIS, PPQ. Access to these plants is limited to appropriate Regulatory Officials. These plants are not to be sampled, sold, or moved within the nursery, unless under the supervision of a Regulatory Official. In addition: [Select option a. or b. below]
 - a. If this nursery is a production/wholesale nursery then add the following language to Section 16 of the EAN. The following shall also be prohibited from movement pending further notification by USDA, APHIS, PPQ:
 - 1. all high priority target host plants
 - 2. all other HAP located in the high priority target block
 - 3. all medium priority target plants

OR

- b. If this nursery is a retail nursery then add the following language to Section 16 of the EAN. The following shall also be prohibited from movement pending further notification by USDA, APHIS, PPQ
 - 1. all high priority target and medium priority target plants in the nursery.
 - 2. all other HAP within 2 meters of the high priority target plants.

7. Plants to be held

- For production/wholesale nurseries:
 - a. Place a hold on all high priority target plants and all other HAP in the block where the high priority target plants have been located at the trace forward nursery.
 - b. All medium priority target plants are to be held.
 - c. All other HAP in the trace forward nursery is not required to be held under this protocol because risk of spread in non-TF blocks is low. Inspectors may place other plants and other HAP, products or articles that present a risk of spreading *P. ramorum* on hold at any time per Federal and State authorities.
- For retail nurseries (because plant propagation does not occur on site risk is lower):
 - a. Place a hold on all high priority target plants and all other HAP within a 2 meter radius of the high priority target plants located at the trace forward nursery.
 - b. All Medium priority target plants are to be held.

- c. All other HAP in the trace forward nursery that are not within a 2 meter radius of high priority target plants are **not** required to be held under this protocol, however inspectors may place HAP, plant products or articles that present a risk of spreading *P. ramorum* on hold at any time per Federal and State authorities (e.g. If plants from the TF nursery have been moved within the retail nursery or commingled with other HAP in that nursery, the additional HAP must also be held.)
- d. Once inspection and sampling are complete, the held plants may be consolidated and segregated. If the plants are not consolidated and segregated, then the affected portion of the nursery must be closed to the public. With the approval of the regulatory officer, segregated plants may be moved to a site within the nursery or to a location away from the nursery. Any movement of the segregated plants must be done in a manner that will safeguard and prevent the spread of the disease at the nursery, and be conducted under the direction and oversight of a regulatory official. Segregation must include storage on a hard impermeable surface (e.g. a 45 mil thick pond liner or concrete or asphalt) and may not be within 2 meters of any other plant. The 2 meter requirement addresses the spread potential of *Phytophthora ramorum* should any TF plants be positive. The impermeable surface should ideally be situated to drain away from HAP.

8. Determining number of plants to be inspected

- Determine, if possible, all TF HAP genera at the receiving nursery and visually inspect all TF HAP genera at the receiving nursery. If TF HAP plants can not be determined, visually inspect at least 850 HAP plants of the same genera shipped from the TF nursery.
9. Visually inspect the appropriate number of HAP for unhealthy tissue. To visually inspect a plant, carefully lift the plant from surrounding plants and examine all plant leaves and stems for unhealthy tissue particularly for but not limited to the presence of water-soaked or necrotic lesions consistent with *P. ramorum* infection. Take care to examine the leaves on the interior as they may exist in a microclimate more conducive to disease development and may be more likely to have disease symptoms. Be sure to mark plant as visually inspected either with flagging with the appropriate sample number or a stake with the appropriate sample number. Also examine the leaves that have fallen off the plant for disease symptoms. A physical sample of the inspected plant is only to be taken if unhealthy plant tissue is present. **Do not sample asymptomatic plants**, but feel free to sample any and all plants exhibiting unusual or atypical plant tissue. Images of *P. ramorum* symptoms are available at http://www.aphis.usda.gov/plant_health/plant_pest_info/pram. Keep in mind that these images should only be used as a reference, and should not be considered all inclusive for each species. Links to other sites such as <http://www.cnr.berkeley.edu/comtf/>, which provide nursery guides that describe and illustrate *P. ramorum* infections are also available at http://www.aphis.usda.gov/plant_health/plant_pest_info/pram. These

nursery guides may be viewed and printed from these sites. Symptoms of *P. ramorum* may include:

- Leaf spots
- Twig dieback
- Stem cankers

Keep in mind that many other pathogens cause similar symptoms. Remember that other symptoms caused by *Phytophthora ramorum* as yet unseen may be detected, so sample any unusual or atypical plant symptoms.

10. **SAMPLE PLANT TISSUE from any and all visually inspected plants that appear unhealthy.** Each sample should consist of a minimum of five leaves; for vaccinium and other small leaf hosts collect the terminal last 3 inches of branch tips, if present, from each unhealthy plant. If, however, only one leaf is symptomatic include only the one leaf with lesions. Please examine any other leaves on the plant for the presence of lesions, because chances are much smaller lesions may be present on other leaves of the same plant. Take care to examine the leaves on the interior as they may exist in a microclimate more conducive to disease development and may be more likely to have disease symptoms, not forgetting the leaves that have fallen off. If certain areas of the nursery are more prone to disease development (such as low areas where water might puddle or places where mist or fog persists) these areas should be included in the sampling process.

For all samples:

- Fill out PPQ Form 391 (Name of host, variety, state code, facility code, etc.).
- Assign a unique sample number using the following conventions:
XX-ABC-0001
where XX is your two-letter state code, ABC is a three-letter, state-assigned facility code, and 0001 is the sample number for that facility.
- Log each sample according to the unique sample number.
- Double bag samples (e.g., symptomatic leaf tissue with associated twig intact) in plastic bags.
- Label with collection date, time, location, responsible party. Be sure to write sample number on the bag containing the sample.
- Be sure to mark sampled plants either with flagging with the appropriate sample number or a stake with the appropriate sample number.
- Refrigerate, but do not freeze specimen.
- Submit with minimal delay to your designated laboratory for analysis. All tissue samples must be analyzed by APHIS-approved or APHIS provisionally-approved Laboratory using the appropriate diagnostic protocols.
- Overnight the sample if necessary – do not send samples on Friday or the day before lab holidays – check with the lab – as they may not be received until the following Monday. Samples held in a shipper's warehouse without refrigeration may deteriorate and not be testable. Identify the sample(s) as Trace Forward (TF) Sample to distinguish the sample(s) from National Survey samples.

11. Ask owner/manager to identify cull or waste/refuse piles and compost piles. Check any piles for *P. ramorum* symptomatic plants and plant material and sample as above, if observed.
 - Include appropriate sampling and testing of soil and water. Soil should be tested underneath piles. Water should be baited and sampled from downward slopes, as well as any collected or drained reservoirs from the site.
12. If the survey requires the inspector to move among multiple greenhouses, shade houses or discrete blocks, disinfect tools, hands and shoes (or wear disposable gloves and tyvek booties) to prevent pathogen spread between areas. If using disposable gloves and booties, be sure to dispose of these after each individual greenhouse/shade house/block inspection. Disposable rubber gloves and tyvek booties can also be disinfected using 10% bleach solution or a quaternary ammonium solution (at the labeled rate) between inspecting each area. See Exhibit E for details on disinfectants and fumigants for use in nurseries. (Washtubs with ~ 1/2 inch of disinfectant to step in for booties and 3 inches in buckets to dip gloved hands should be sufficient.) Be sure to properly disinfect booties and gloves between all nursery blocks. Disposable gloves and booties should be bagged and disposed by burial or incineration, or in a landfill upon completion of inspections.
13. Sanitize/disinfest tools and shoes before leaving premises, using an appropriate disinfectant for the control of *Phytophthora spp.* (such as a 10% solution of bleach or quaternary ammonium solution at labeled rates). See Exhibit E for details on disinfectants and fumigants for use in nurseries.
14. Advise the owner/manager –
 - The plants will remain on hold until further notification from USDA, APHIS.
OR
 - For Production/Wholesale Nurseries:
 - a. Once plant samples are taken, the owner/manager may choose to voluntarily destroy all HAP in the nursery once sampling is completed. After the plants have been destroyed, the establishment can continue to do business without any regulatory restrictions. Destruction and disinfestation will be performed as per the APHIS, PPQ Confirmed Nursery Protocol. Destruction and disinfestation to be conducted under the supervision of a Federal or other appropriate regulatory official. If plant samples are found positive for *P. ramorum* whether the plants are remaining on the site or have been destroyed, the APHIS, PPQ Confirmed Nursery Protocol for Wholesale and Production Nurseries will be applied.
 - b. Where many samples have been taken, plants may be released on a block by block basis if *P. ramorum* has not been detected in the block after all test results for that block are available.
 - For retail nurseries:
 - a. Once sampling is completed the owner/manager may choose to voluntarily destroy the HAP received from the TF nursery and all other plants within 2 meters of the trace forward plants. After the

plants have been destroyed, the establishment can continue to do business without any regulatory restrictions. Destruction and disinfestation will be performed as per the PPQ Retail Confirmed Nursery Protocol. Destruction and disinfestation to be conducted under the supervision of a Federal or other appropriate regulatory official. If plant samples are found positive for *P. ramorum* whether the plants are remaining on the site or have been destroyed, the APHIS, PPQ Confirmed Nursery Protocol for retail nurseries will be applied

- b.** The high priority target plants and plants in the 2 meter quarantine radius may be treated as a quarantine block and plants may be released on a block by block basis if *P. ramorum* has not been detected in the block after all test results for that block are available.
- **If any plant samples are found positive for *P. ramorum* whether the plants are remaining on the site or have been destroyed, the APHIS, PPQ Confirmed Nursery Protocol for production/wholesale nurseries or the Confirmed Nursery Protocol for retail nurseries will be applied, whichever is applicable.**
- **If any samples associated with the cull piles are found positive for *P. ramorum*, the APHIS, PPQ Confirmed Nursery Protocol for production/wholesale nurseries or the Confirmed Nursery Protocol for retail nurseries will be applied whichever is applicable.**

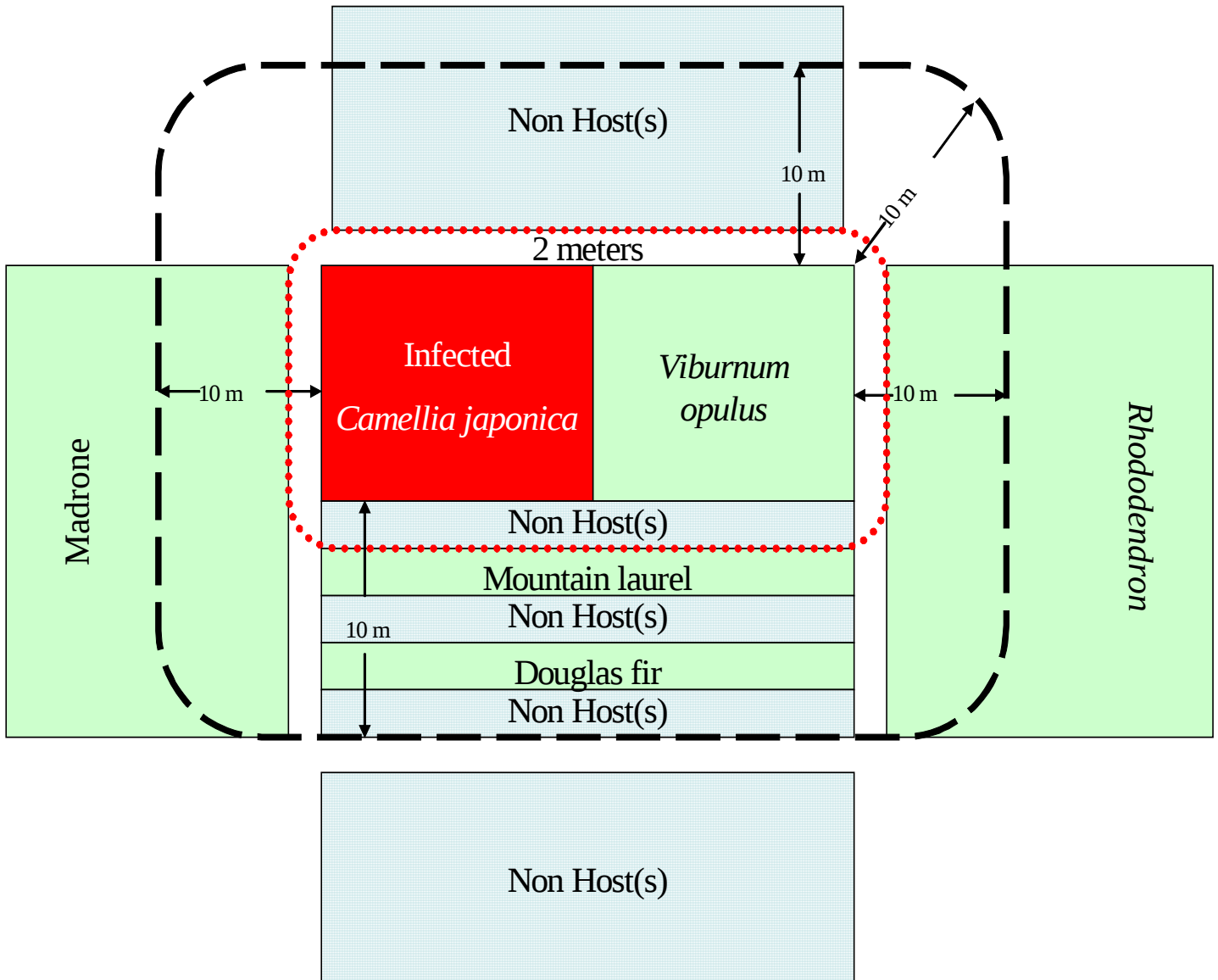
Appendix A

APHIS List of Regulated Hosts and Plants Associated with *Phytophthora ramorum*

A current list may be found at the USDA APHIS PPQ website at
http://www.aphis.usda.gov/plant_health/plant_pest_info/pram/

Appendix B

Schematic of Nursery with Infected Host Plant(s)



Destruction Block

Action: Destroy *Camellia japonica* and *Viburnum opulus*. Hold and monitor all non-hosts.



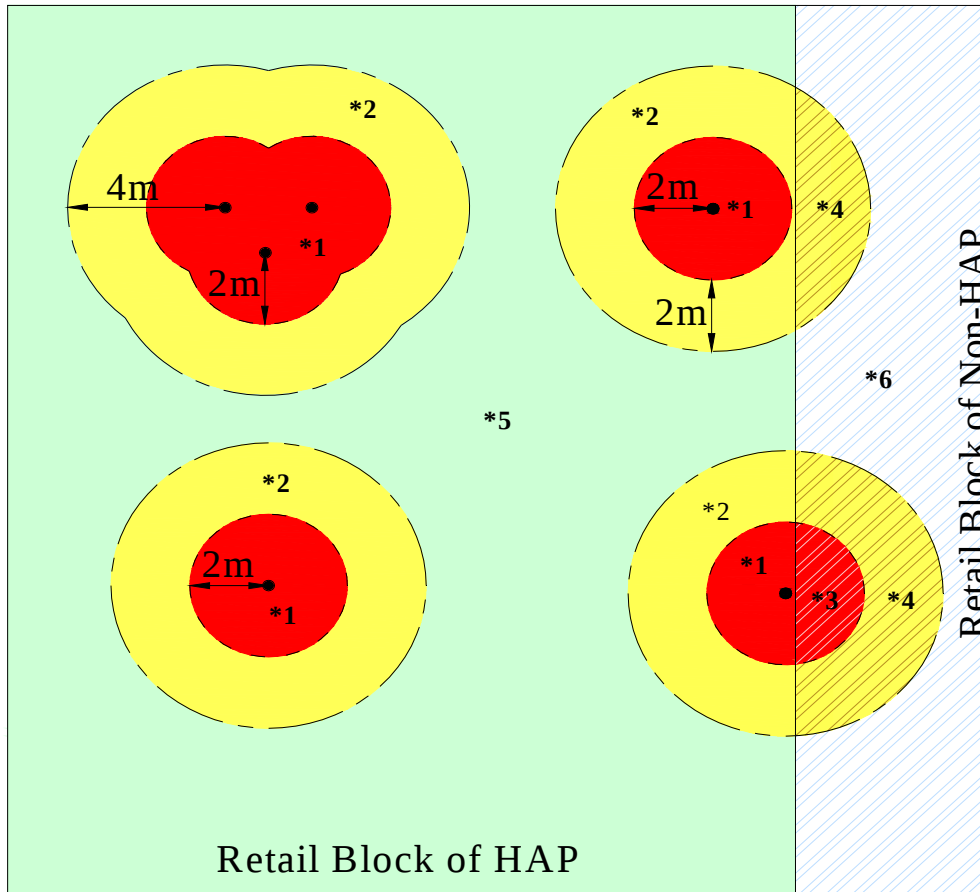
Quarantine Block

Action: Hold and monitor all Mountain laurel and Douglas fir, as well as some Madrone and Rhododendron.

Appendix C

Schematic of Retail Nursery with Infected Host Plant(s)

July 9, 2007



Red (* 1)	Destruction block	Destroy infected plant and all HAP
Yellow (*2)	Quarantine block	Hold HAP from sale for 90 days
Hatch Over Red (*3)		Release non-HAP from sale
Hatch Over Yellow (*4)		Release non-HAP for sale
Green (*5)		Release HAP for sale
Blue Hatch (*6)		Release non-HAP for sale

Appendix D

***Phytophthora ramorum* Questionnaire (Property Owner or Manager): Part 1**

Name of Nursery or Garden Store: _____.

Name of Owner or Manager: _____

Address of Site: _____

City: _____, State: _____, Zip Code: _____

Contact Name: _____, Title: _____

Phone Number: _____, Fax Number: _____

GIS Coordinates (if available): _____

Type of Facility (circle): Nursery Greenhouse Wholesale Retailer
Other _____

1. Are you the owner or manager of the property or facility? If not please provide owner contact information. _____
2. Did you purchase the plant(s) in question? (If “no”, seek information on individual who planted material in question) _____
3. How long ago did you purchase the plant(s)? _____
4. Did you purchase any other plants from this same nursery? _____
5. Have you noticed any other problems with plants on your property? _____
6. Have you moved any plants, received from the infested nursery, from your primary retail location to a different location? _____
 - a) What types and varieties were they? _____

 - b) How long ago was that? _____
 - c) What is the address of that location? _____

7. Did you move any plants here from a different location? _____

a) What types and varieties were they?

b) How long ago was that? _____

c) What is the address of that location?

8. Do you have a landscape company that purchases plants from you? _____

9. What is the contact information for the landscape company? _____

10. What is your source of water? _____

***Phytophthora ramorum* Questionnaire (Property Owner or Manager): Part 2**

Information on suspect plant material for inspector visiting property:

1. What is the variety and number of plants? _____

2. What is the condition of the plant material? _____

3. Have the plants been trimmed or pruned? _____

4. How are the trimmings disposed of? _____

5. Did the plant material come in pots? _____.

a) Did you dispose of the pots or re-use them? _____

6. If the pots were reused or stored, describe how the pots were handled?

Appendix E

Treatment and Disinfection

The following techniques are approved by USDA APHIS PPQ for control of *P. ramorum* in nurseries found to contain plants infected with *P. ramorum*.

Infected Plants:

Note: HAP material, including leaf litter, must not be placed in compost piles or be removed from the nursery site as trash or in debris removal. HAP material should be collected and incinerated or double bagged and deep buried in a site approved by USDA, APHIS or delegated regulatory authority.

- **Incineration (burning to ash):** Infected plants, associated growth media, associated containers (i.e. pots and trays), all leaf debris in and around the area where plants were stored may be disposed of by incineration at a facility or other location (e.g. on site) approved by USDA and permitted within state and municipal statutes or regulations. Off nursery movement must be properly safeguarded and every effort to prevent plant debris or soil from being dislodged from the plants prior to incineration should be taken. Burning may be through open burning or in an incinerator.
- **Deep burial:** Infected plants, associated growth media, associated containers (i.e. pots and trays), all leaf debris in and around the area where plants were stored must be double bagged using plastic bags of 2 mil thickness or greater and buried to a depth of no less than two meters. The material must be buried at a USDA approved site, onsite, or municipal landfill, which is expected to remain undisturbed. Every effort to prevent plant debris or soil from being dislodged from the plants should be taken.
- **Steam sterilization:** Dry heat or steam commonly heated to internal temperatures of 212° F (100° C) for 30 minutes followed by burial in a landfill, or as otherwise detailed in the USDA Treatment Manual for “insect pests and pathogens in garbage”, Schedule T415b (http://www.aphis.usda.gov/ppq/manuals/pdf_files/Treatment%20Chapters/05-05-T400-5.pdf).

Non-Porous Surfaces:

Most disinfectants are not labeled for use in soil and are only useful for nonporous materials such as concrete floors, nursery pots, and plastic sheeting. A number of disinfectants are registered for use on nonporous surfaces that may effectively reduce populations of *Phytophthora* species. If it is practical, tools such as knives, pruners, water breakers, water wands and other implements used in the quarantine area should only be used in the quarantine area. If tools and other implements must be moved from the quarantine area, then regular disinfection using an appropriate disinfectant for the control of *P. ramorum* is recommended prior to removal from the quarantine block. The following table modified from <http://cpmcnet.columbia.edu/dept/ehs/decon.html> examines the effects of different classes of disinfectants on microbial populations. This list is for explanation and information

only. Few disinfectants are specifically labeled for *Phytophthora* species and are shown in **Bold**.

All labels for the disinfectants listed below must be strictly adhered to for maximum efficacy and environmental and worker safety.

Summary of Disinfectant Activities

Disinfectant	Trade names	Comments	Contact time
Alcohols (ethyl and isopropyl) 60-85%	Lysol Spray	Evaporates quickly so that adequate contact time may not be achieved, high concentrations of organic matter diminish effectiveness; flammable.	10-15 minutes
Phenolics (0.4%-5%)	Pheno-cen	Phenol penetrates latex gloves; eye/skin irritant; remains active upon contact with organic soil; may leave residue.	10-15 minutes
Quaternary Ammonium (0.5-1.5%)	Consan Triple Action 20 Physan 20 Green-Shield 20	Effective for non-porous surface sanitation (floors, walls, benches, pots). Low odor, irritation. Use according to labels.	10-15 minutes
Chlorine (100-1,000 ppm)	10% Clorox 10% Bleach	Inactivated by organic matter; fresh solutions of hypochlorite (Clorox) should be prepared every 8 hours or more frequently if exposed to sunlight; corrosive; irritating to eyes and skin. Exposure to sunlight further reduces hypochlorite efficacy. Keep solution in opaque container.	10-15 minutes

Water:

- **For dust abatement, fire suppression, and equipment cleaning:** Clorox (sodium hypochlorite) is labeled (EPA Reg. No 5813-50) for treatment of water (~50 ppm available chlorine) for controlling the spread of *Phytophthora lateralis* via water used for dust abatement, fire suppression and equipment cleaning. The active ingredient level must be measured from water collected at the sprinkler head.
- **For irrigation:** Chlorine levels of 2ppm or 2mg/liter or greater has been correlated with the control of *Phytophthora* spp. in re-circulated irrigation systems. For irrigation purposes, re-circulated, non-municipal water, must be chlorinated at an active chlorine concentration

equal to or greater than 2 mg/liter of water; for facilities that recycle water, this chlorine level must be monitored.

Soil and Potting Media:

- **Potting media:** Potting media must be heated such that the temperature in the center of the load reaches at least 180 degrees F for 30 minutes. Treatment must be conducted in the presence of an inspector or treated with an approved fumigant as detailed below.
- **Soil:** Soil must be heated such that the temperature in the center of the load reaches at least 180 degrees F for 30 minutes. Treatment must be conducted in the presence of an inspector or treated with an approved fumigant as detailed below. Methyl bromide has been used for fumigating wood products, but the data on fungi and related organisms in wood are limited. However, methyl bromide has a long history of fumigation of soil in the field and greenhouse. It has commonly been used in combination with chloropicrin for control of *Phytophthora* spp. and other pests in strawberry beds. Methyl bromide has been used for soil treatment for the mitigation of *P. cinnamoni* in citrus groves. However, many of the compounds currently in use have been implicated in human and environmental risks. Solarization is not a consideration as a viable option for soil treatment for *P. ramorum* due to insufficient data on treatment efficacy.

All fumigants are restricted use and must be applied according to labels by a licensed applicator. Any use of pesticides in any manner not listed on the label is unlawful.

Summary of Labeled Soil Fumigants

Fumigant	Trade names	Comments
Chloropicrin	Chlor-O-Pic Metapicrin Timberfume Tri-Clor	Often used in combination with methyl bromide due to its ability to be detected in small quantities.
Dazomet	Basamid	Methyl isothiocyanate (MITC) breaks down into cyanide gas. Granular formulation that is water activated.
Metam-sodium	Busan 1020 Busan 1180 Busan 1236 Metam Vapam	Metam can be applied through irrigation. Tarping can increase efficacy. All application must be made in accordance with labeling.
Methyl Bromide	Tri-Con Terr-O-Gas Preplant Soil Fumigant Pic-Brom	Colorless and odorless. Usually combined in various concentrations with Chloropicrin (tear gas). Use is restricted due to ozone depletion potential.

Physical Treatment of Soil:

- Mitigation of infested soil can also be achieved by installing permanent impermeable, non-porous barriers that consist of cement, concrete or asphalt. These barriers must be constructed so that no native soil within the destruction block is visible. The barriers should be graded such that no standing water can be observed.

Equipment and Personnel (Inspectors and employees):

- **Access to infested areas and hold areas should be limited, as much as possible, to officials and employees. Everyone entering and leaving the nursery site must scrape off loose pieces of soil into the destruction block. Those working with, or in contact with suspected infested material (including plants), must wash hands using soap or approved disinfectant immediately after completion of task. There are no products currently labeled for use on porous materials for *Phytophthora* control.**
- Personnel should not have access to other parts of the nursery after entering the destruction block on the same day. If entry is unavoidable, follow disinfection procedures in this section.
- A disinfectant foot bath should be placed near the exit to the destruction blocks and quarantine blocks and used by personnel entering and exiting the buffer zone and entering and exiting the quarantine block and entering and exiting the destruction block at the infested nursery site, where the contact with potentially infested soil or plant debris on footwear is likely. The foot bath must be filled with fresh disinfectant at least on a daily basis or more frequently if contaminated with filth, in accordance with label directions. Use of disposable shoe covers may be used in lieu of a footbath, if disposed of immediately upon exiting from the quarantine or destruction block. The disposable shoe covers must be placed in bags and incinerated, deep-buried or properly disposed in a sanitary landfill.
- The tires (or other parts in contact with the soil or plants, such as the bed of trucks) of vehicles must be cleaned of loose soil and plant debris and disinfested with the appropriate labeled products before leaving the infested site. If at all possible, vehicles should not be allowed in the destruction blocks at all. Any efficacious product labeled for use on non-porous surfaces may be used on tires or vehicle undercarriages.
- Do not visit other nursery sites in potentially contaminated work clothing and footwear. Where it is necessary that visitors enter the nursery, the nursery should ensure that every precaution is taken to prevent the movement of infected plants, contaminated soil or debris by the visitor.

Wood surfaces suspected of contamination with *P. ramorum* should be disposed of as stated above under “Infected Plants”. There is no effective way to test or treat wood surfaces for contamination.