Pest management specialists must recognize that the benefits of insecticide application have not been clearly demonstrated. Insecticides **do not** prevent pathogen infection and tree death, as the pathogen alone is capable of killing trees. Chemical applications may have adverse environmental impacts, and improper tree injection may spread the pathogen, other diseases, or pests. Simply because a pesticide is listed for a tree does not make its application effective or ethical. If an insecticide is to be used, apply it only if the disease is not at an advanced stage and realize it may only prolong the life of the tree for a relatively short period of time.

Tree removal

Trees infected or killed by *P. ramorum* are prone to rapid decay and unpredictable failure. Arborists and other tree care professionals need to be very cautious about climbing P. ramorum-infected or killed trees. **Infected green trees, as well as trees killed by *P. ramorum* and/or secondary pests, are at increased risk of trunk and limb breakage.** Prior to the removal of Sudden Oak Death-infected trees, provide a "tailgate safety talk" that covers points discussed below to inform crews of special precautions for working in structurally compromised trees.

A study of the failure potential of coast live oak trees found a strong association between branch, scaffold limb, bole, and root crown failures, and advanced symptoms of *P. ramorum* infection. At least one third of these failures occurred in live trees and stems. Wood decay was present in almost all failures and was the most consistent and important factor influencing failure potential. Trees with indications of wood decay or deterioration because of beetles and *Hypoxylon* should be removed if they jeopardize emergency access/egress, life, or property. Evaluate structural hazard potential and remove those trees that pose a risk to people, property, pets, livestock, etc. Also consider removing recently killed trees and brush to lessen the fire hazard potential.

Coast live oak trees are also prone to summer branch failure. Reduced moisture content in infected trees may contribute to branch failure. The wood of *P. ramorum*-infested trees appears to decay rapidly, resulting in failure often within a few months of dying. There have been reports of diseased trees heavily colonized by bark and ambrosia beetles and the *Hypoxylon* fungus failing before they have died (while they are still green). Trees that are hazardous to life, property, roads, park trails, campgrounds and other high use areas should be felled without delay. **The arborist should pay special attention to Sudden Oak Death trees with internal decay or other structural defects that could increase failure potential or threaten the safety of tree workers.**

Cut tree stumps as close to the ground as practical. Stump grinding is not recommended because the equipment may become contaminated by soil and result in pathogen spread when used at another location. The operation of vehicles or heavy equipment in such areas may lead to further disease spread when soil is disturbed and moved around. If at all practical, schedule tree removals from June to October when conditions are warm and dry, and avoid removing diseased trees when moist conditions favor pathogen spread – November to May.

Debris disposal

Proper disposal of infested material is an effective means of limiting pathogen spread. In generally infested areas, leaving *P. ramorum*-infected or killed trees on site has not been shown to increase the risk of infection to adjacent trees. Removal from the property is only recommended if it is the first infected tree to be detected in the area, or if fire risk is high. Whenever possible, leave tree debris on site in a safe area where large woody debris will not move, endanger children, contaminate uninfected hosts, or constitute a fire hazard. When infected oaks are cut down and left on site, chip the branches and cut and split the wood. Stack woodpiles in sunny locations to promote rapid drying. Do not leave firewood and chips in an area where they might be transported to another location (e.g. curbside, freeway medians, etc.).

Try to dispose of infested materials down slope of, and away from host species. Most dead oaks in rural areas are not easily disposed of due to the steep or rugged terrain or lack of access. Such trees may be felled or left to fail on their own, depending on whether there is a target of value. Leaving infected trees intact on site will benefit wildlife. Dead trees on the edge of oak woodlands adjacent to grass or brush areas (transition zones) can exacerbate fire behavior and encourage canopy fires in woodlands. Such trees should be cut up and moved 10 to 30 feet away from the remaining trees, depending on slope. If chipping is not possible, reduce fire hazard by lopping and scattering branches so they lay close to the ground at least 30 feet away from any structure, driveway, roadside or propane tank (Consult your local fire department.).

If debris cannot be left on site, infested material should be disposed of at an approved and permitted dump facility. Quarantined materials may move within the regulated area (in California, the 14 infested counties), but not into unregulated areas without approval of the county agricultural commissioner. Do not sell or buy host plants, firewood, wood chip or bark mulch, or compost that originated within the regulated area without first contacting your local agricultural commissioner's office.

Sanitation measures to minimize pathogen spread

As a precaution against spreading the pathogen, clean and disinfect pruning tools after use on confirmed or suspected infested trees or in known infested areas. Sanitize pruning tools before pruning healthy trees or working in pathogen-free areas. Clean chippers and other vehicles of mud, dirt, leaves and woody debris before leaving a *P. ramorum* site and before entering a site with susceptible hosts.

Before working

· Inform crews about the arboricultural implications of *P. ramorum* and sanitation practices when they are working in infested areas.

· Provide crews with sanitation kits. (Sanitation kits should contain the following: Chlorine bleach [10/90 mixture bleach to water] or Clorox Clean-up®, scrub brush, metal scraper, boot brush and plastic gloves).

· Sanitize shoes, pruning gear and other equipment before working in an area with susceptible species.

While working

· When possible, work on *P. ramorum*-infected and susceptible species during the dry season (June-October) or ask costumers to allow flexible scheduling so work may be done during dry spells. When working in wet conditions, keep equipment on paved or dry surfaces and avoid mud.

· Work in disease-free areas before proceeding to infested areas.

· Do not collect soil or plant material (wood, brush, leaves and litter) from host trees in the regulated area without first contacting your local agricultural commissioner. Within the regulated area, host material (e.g., wood, bark, brush, chips, leaves or firewood) from tree removals or pruning of symptomatic or non-symptomatic plants should remain on site to minimize pathogen spread.

After working

· Use all reasonable methods to sanitize personal gear and crew equipment before leaving a *P. ramorum*-infested site. Scrape, brush and/or hose off accumulated soil and mud from clothing, gloves, boots and shoes. Remove mud and plant debris by blowing out or power washing chipper trucks, chippers, bucket trucks, fertilization and soil aeration equipment, cranes, and other vehicles.

· Restrict the movement of soil and leaf litter under and around infected trees as spores may be found there. Contaminated soil, particularly mud, on vehicle tires, workers boots, shovels, stump grinders, trenchers, etc., may result in pathogen spread if moved to a new, uninfested site. Remove or wash off

soil and mud from these items before use at another site. If complete on-site sanitation is not possible, complete the work at a local power wash facility or an isolated area in your equipment yard. Clean, orderly vehicles and equipment are good business, and prevents pathogen and insect spread.

· Tools used in tree removal/pruning may become contaminated and should be disinfected with Lysol® spray, a 70% or greater solution of alcohol, or a Clorox® solution (1 part Clorox® to 9 parts water or Clorox Clean-up®). Remember that these products are corrosive to metal and fabric. Rinse your gear after sanitation.

· Report suspected cases of *P. ramorum* to the local county agricultural commissioner.

Tree care considerations

Keeping oaks healthy by creating favorable growing conditions, avoiding disturbances to the root zone, avoiding unnecessary pruning, pruning properly, avoiding harmful landscaping and gardening practices, and mitigating environmental stress is prudent for the general health of oaks, but may not prevent Sudden Oak Death. This disease is caused by a virulent pathogen, capable of killing apparently healthy trees.

Although native oaks are well-adapted to their local environment, various climatic events and disturbances within the root zone can cause stress and increase vulnerability to pest attack. Drought, unusually wet springs, regular and frequent irrigation, root loss, poor drainage, soil compaction, and pavement are common factors causing stress. Maintaining or restoring favorable growing conditions and avoiding disturbances are the best ways to maintain tree health.

Pruning: Pruning of host plants should be avoided or minimized during this outbreak, as wounds may serve as entry sites for this disease and attract bark beetles. Also, arboricultural work and equipment may transport infectious spores to uncontaminated sites. Prune only as necessary and avoid excessive foliage removal. Removing more than 20% of a mature oak's foliage can impair its health. If possible, avoid pruning in winter and spring months, when there is increased risk of pathogen spread. Work with clients to schedule pruning of *P. ramorum*-infected trees or shrubs, or host species during the dry months of June through October. **Never** use hooks (climbing spikes) in trees to be retained (removals only). Strictly follow arboricultural pruning standards (ISA Pruning Standards and ANSI A300).

References and resources

- Distribution of Sudden Oak Death: kellylab.berkeley.edu/SODmonitoring/OakMapper.htm
- Drying infested wood to destroy the pathogen: ceres.ca.gov/foreststeward/html/treenotes.html
- Failure potential in coast live oak: www.phytosphere.com/publications/Phytophthora_failure2003.htm
- California Department of Food & Agriculture (CDFA): www.cdfa.ca.gov/index.htm
- USDA, Animal & Plant Health Inspection Service (APHIS): www.aphis.usda.gov/ppq/ispm/sod
- The California Oak Mortality Task Force (COMTF): www.suddenoakdeath.org

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