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Subject: Priorities for borate stump treatments to prevent *Heterobasidion* root disease (HRD) (**FHP Report # RO-21-02**). June 25, 2021.

HRD is one of the most important conifer diseases in California. According to estimates, the disease infests about seven million acres of commercial forest land in California (Smith 1984), causing an estimated annual volume loss of 19 million cubic feet. Potential impacts of the disease include increased likelihood of mortality during drought, increased susceptibility to bark beetle attack, increased fire danger, increased susceptibility to windthrow, loss of wood-production, and mortality of infected trees and loss of vegetative cover. In addition, disease-caused windthrow in recreation areas and administrative sites can be highly hazardous, leading to human injury or even death or damage to permanent infrastructure and property.

Over the past 170 years, HRD has increased its distribution and impact in California. Surveys show that almost all coniferous forests in California have at least low levels of HRD or have live *Heterobasidion spp.* spores in the air capable of infecting freshly-cut conifer stumps.

Most new infections of stumps by HRD can be prevented by treating freshly cut conifer stumps with a borate pesticide. Studies indicate at least a 90% efficacy. However, treating stumps is not always necessary. The table on the following page, prepared by R5 Forest Health Protection specialists, lists the ‘**Priorities for borate stump treatments to prevent HRD.**’ This information can help planners decide the project areas and types of stumps to prioritize for treatment with borate fungicides. Please contact your FHP Service Area professionals with any questions. Their contact numbers are provided in the following link: <https://www.fs.usda.gov/detailfull/r5/forest-grasslandhealth/?cid=stelprdb5346010&width=full>

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Reference: Smith, R.S. 1984. Root disease-caused losses in the commercial coniferous forests of the western United States. Methods Application Group Report No. 84-5. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Forest Pest Management. 21 p.

Priorities for stump borate treatments to prevent Heterobasidion Root Disease (HRD) v.4.5
Contact your Forest Health Protection Entomologist or Plant Pathologist for assistance

USFS Region 5 - BORATE STUMP TREATMENT PRIORITY BY FOREST CONDITION and HARVEST ACTIVITY			
Priority	HARVEST ACTIVITY in FOREST TYPE and CONDITION	*TREAT WHICH STUMPS?	WHY
Very Low	Salvage high severity burn (nearly all trees killed); plant	NONE	Little connectivity with seedling roots; Most dead roots get infected with competing organisms before seedling roots contact them
Very Low	Clearcut PP/J/P, true fir or mixed conifer; any location including roadsides and powerline corridors	NONE	Very low probability of new establishing new infection centers
Very Low	Thin true fir which has widespread light to heavy HRD	NONE	Borates do not cure existing infection
Low	Thin PP/J/P with no current or historic pine HRD within 1700 feet	NONE	Very low atmospheric spore concentration
Low	Thin PP/J/P in mixed species stands; few >14" PP/J/P stumps	NONE	Small pine stumps don't create HRD centers; small roots get infected fast with competing organisms
Low	Thin PP/J/P in mixed species stands; few pine-to-pine root contacts	NONE	HRD won't spread from stumps that don't have root contact w/ live trees
Low	Thin Doug-fir; incense cedar; sugar pine; other conifers	NONE	Little evidence of HRD problems
Moderate	Salvage low to moderate severity burn (scattered remaining green trees)*	Consider treating >14" PP/J/P and > 24" juniper stumps having possible root contact with high-value PP/J/P. Treat true fir stumps in stands with no fir HRD	Borates do not cure existing infections. Treating pine stumps near high-value pine trees can protect residual pine from HRD. Large juniper stumps may facilitate spread to adjacent pines.
High	Any cutting, PP/J/P, true fir in roadside and powerline corridors (including hazard tree removal and salvage* in low to moderate severity burns)	Treat all PP/J/P and > 24" juniper stumps and true fir stumps >14"	Borates prevent infection; lower tolerance for new HRD centers in these areas. Large juniper stumps may facilitate spread to adjacent pines.
High	Thin PP/J/P in mixed species stands; many >14" PP/J/P stumps and pine-to-pine root contacts; pine HRD within 1700 feet (or distance to nearest HRD not known)	>14" PP/J/P stumps (also >24" juniper stumps if present)	Borates prevent infection. Large juniper stumps may facilitate spread to adjacent pines.
High	Thin true fir with no HRD	> 14" fir stumps	Borates prevent infection
Very High	Thin PP/J/P, many >14" stumps; pine HRD within 1700 feet (or distance to nearest HRD not known)	>14" PP/J/P stumps	Every stump can start HRD centers
Very High	Recreation and Administrative Sites	>3" conifer stumps	Zero tolerance for new HRD centers in these areas means treating smaller stumps of all conifer species
* No need to treat stumps of trees with no needles or stumps of trees killed by fire >18 months earlier			