

6.4 Forest Protection

This section is intended to supplement the Timber Resources Section of this document. A detailed discussion of pest management activities, while not necessarily required under CEQA, is an important component of JDSF management activities.

6.4.1 Regional and Project Setting: Forest Pests and Diseases and Integrated Pest Management

Common Forest Pests and Diseases

Both endemic and introduced forest pests such as insects, diseases, and vertebrates have long been established in California's native timberlands. Weeds are also considered forest pests (see the Botanical sections of this document). Pest populations are dynamic and fluctuate in response to climatic and environmental changes (i.e., drought, forest stocking, windthrow, and fire) and other site disturbances, including forest management activities. The effects of pests may reduce tree growth, affect species composition, or impact forest stocking. At the same time, other forest resources, such as wildlife habitat, may be impacted by the change in forest structure brought upon by excessive tree mortality. Integrated forest pest management (IPM) provides a means to address these issues [DFMP, Chapter 3].

The California State Board of Forestry and Fire Protection (BOF) has included Mendocino County within the Zones of Infestation for pitch canker disease since 1997 and for sudden oak death (SOD) since 2001. Both pitch canker and sudden oak death are present in southern Mendocino County, but are not known to occur on JDSF. CDF continues to sample for pitch canker and survey for SOD within JDSF, with no detections to date.

Pests known to have caused tree mortality within or adjacent to JDSF are listed in Table VII.6.4.1. There may be other pests of local tree species that are seldom detected or reported, or that are not usually lethal to trees beyond sapling sized, such as western gall rust on Bishop pine.

Sudden Oak Death

Sudden oak death (SOD) is a canker disease of tanoak and several oak species, and is a twig or foliar pathogen on most other hosts. The disease symptoms were first reported in 1995 in Marin County, and SOD has since spread to include 14 coastal counties in California (Alameda, Contra Costa, Humboldt, Lake, Marin, Mendocino, Monterey, Napa, San Francisco, San Mateo, Santa Clara, Santa Cruz, Solano, and Sonoma), and portions of one in Southern Oregon (Curry County). SOD has not been found on JDSF, and geographically the nearest known incidence, as of May 1, 2005, is approximately twenty miles SSE (north of Booneville, above Indian Creek). The rapid spread of SOD regionally, and the presence of most of the known wildland host plants on JDSF, justify the need for careful forest management to minimize SOD impact upon the Forest. Presented

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here is an overview of our current knowledge of sudden oak death. For the most current information about sudden oak death, see the California Oak Mortality Task Force website (<http://www.suddenoakdeath.org/>).

Table VII.6.4.1. Common Forest Pests on Jdsf.¹					
Diseases	Douglas-Fir	Grand Fir	Mendocino Cypress	Western Hemlock	Redwood
<i>Heterobasidion annosum</i> Annosus root disease	X	X			
<i>Armillaria mellea</i> Armillaria root disease	X	X	X	X	X
<i>Leptographium wageneri</i> var. <i>pseudotsugae</i> black stain root disease	X				
<i>Phaeolus schweinitzii</i> velvet top fungus	X				
<i>Phellinus pini</i> white pocket rot	X	X			
Insects					
<i>Melanophila drummondi</i> flathead fir borer	X				
<i>Dendroctonus pseudotsugae</i> Douglas-fir bark beetle	X				
<i>Scolytus unispinosus</i> Douglas-fir engraver beetle	X				
<i>Pseudohylesinus nebulosus</i> Douglas-fir pole beetle	X				
<i>Scolytus ventralis</i> fir engraver beetle		X			
<i>Pseudohylesinus seriaceus</i> silver fir beetle	X	X			
<i>Phloeosinus sequoiae</i> redwood bark beetle					X
Vertebrates					
(several species suspected) ² tree squirrel(s) (upper stem girdling)					X
<i>Odocoileus hemionus</i> ³ blacktail deer (seedling/sapling browsing damage)	X	X	X	X	X
<i>Neotoma fuscipes</i> dusky-footed woodrat (girdling of branches and top)					X
¹ Robinson, 1993. ² Marshall, 2002. ³ Assumption based upon general knowledge (not documented in the original table).					

The SOD pathogen, *Phytophthora ramorum*, is a newly described fungus species. Dr. David Rizzo of University of California, Davis, and Dr. Matteo Garbelotto of University of California, Berkeley identified it as the causal agent of SOD in the summer of 2000. In the brief time since, the pathogen has been confirmed in a number of California native plant species and in nurseries on ornamentals. CDFA further regulates other California native plants in the form of associated articles (nursery stock). Table VII.6.4.2 provides a list of proven hosts for *P. ramorum*.

Similar symptoms of stem infection by *P. ramorum* occur in tanoak, coast live oak, black oak, and Shreve oak; although their appearance, both chronologically and physically, varies. In tanoak, leaf symptoms are usually the first to appear, and new growth may droop or turn yellow to brown. In coast live oak, black oak, and Shreve oak, the earliest symptom is the appearance of a bleeding canker. Burgundy-red to tar-black thick sap oozes on the bark surface. Similar bleeding, though less viscous, is normally observed on tanoak. This bleeding is a response to infection with *P. ramorum* and is typically found above the soil line from the root crown (the area where the trunk fans out to the roots) to a height of 2 meters. Bleeding has occasionally been observed at greater heights (nearly 20 meters). Oaks and tanoak showing these symptoms may die within a few months of the appearance of symptoms, while some trees may be more tolerant of the pathogen and survive for several years. Other hosts, especially in juvenile stages, may also be killed by *P. ramorum* (Garbelotto, et al., 2002).

The pathogen has also been isolated from soil and rainwater in proximity to infested hosts. Plant hosts having foliar symptoms are important in that the pathogen can rapidly reproduce on the leaf surface, allowing for rapid build-up and dispersal of *P. ramorum* spores to other hosts.

Foliar symptoms vary on many hosts and are often confused with those caused by other agents. Pictures of some of these various SOD symptoms may be found at the California Oak Mortality Task Force web site, www.suddenoakdeath.org. Because bay laurel seems to be the prominent species affected in most areas, and because the success rate with this host is higher than most hosts for recovering the pathogen and confirming its presence, bay laurel will be the only foliar host discussed in this category.

California bay laurel symptoms are confined to leaf spotting and leaf tip or margin blight, often surrounded by a chlorotic halo. Blighted leaf tips or margins usually have an irregular border, along with the halo, between healthy and dead tissues. Leaf tips and margins that collect water are ideal moist locations in which the pathogen infects the leaf tissues. Twig dieback has also been observed on California bay laurel, but it is unknown whether this is due to *P. ramorum*. Plant mortality in bay laurel by *P. ramorum* has not been reported.

Table VII.6.4.2. Proven Hosts for Phytophthora Ramorum.	
Common Name	Scientific Name
bigleaf maple	<i>Acer macrophyllum</i>
black oak	<i>Quercus kelloggii</i>
Bodnant Viburnum	<i>Viburnum x bodnantense</i>
Brouwer's beauty andromeda	<i>Pieris floribunda x japonica</i>
California bay laurel (Oregon myrtle)	<i>Umbellularia californica</i>
California buckeye	<i>Aesculus californica</i>
California coffeeberry	<i>Rhamnus californica</i>
California honeysuckle	<i>Lonicera hispidula</i>
Camelia species, hybrids, & cultivars	<i>Camellia</i> spp.
Canyon live oak	<i>Quercus chrysolepis</i>
coast live oak	<i>Quercus agrifolia</i>
Doublefile Viburnum	<i>Viburnum plicatum</i> var. <i>tomentosum</i>
Douglas-fir	<i>Pseudotsuga menziesii</i>
False Solomon's Seal	<i>Maianthemum racemosa</i> (= <i>Smilacina racemosa</i>)
Forest flame andromeda	<i>Pieris Formosa x japonica</i>
Himalaya Pieris	<i>Pieris formosa</i>
huckleberry	<i>Vaccinium ovatum</i>
Japanese Pieris	<i>Pieris japonica</i>
Laurustinus	<i>Viburnum tinus</i>
madrone	<i>Arbutus menziesii</i>
manzanita	<i>Arctostaphylos manzanita</i>
redwood	<i>Sequoia sempervirens</i>
rhododendron	<i>Rhododendron</i> spp.
Scotch heather	<i>Calluna vulgaris</i>
Shreveoak	<i>Quercus parvula</i> var. <i>Shrevei</i>
tanoak	<i>Lithocarpus densiflorus</i>
toyon	<i>Heteromeles arbutifolia</i>
western starflower	<i>Trientalis latifolia</i>
witch hazel	<i>Hamamelis virginiana</i>
wood rose	<i>Rosa gymnocarpa</i>
1 USDA-APHIS, as of January 10, 2005.	

Pitch Canker

Pitch canker, an introduced fungal disease of mostly pines, is injurious to timber or forest growth in a total of 21 coastal and adjacent counties in the State of California (Alameda, Contra Costa, Los Angeles, Marin, Mendocino, Monterey, Napa, Orange, Riverside, San Benito, San Bernardino, San Diego, San Francisco, San

Luis Obispo, San Mateo, Santa Barbara, Santa Clara, Santa Cruz, Solano, Sonoma, and Ventura). A small number of Douglas-fir also has been infected in Santa Cruz and San Mateo Counties. In late 2003, the presence of the pitch canker pathogen was confirmed on two Douglas-fir trees at the USDA Forest Service Badger Hill Orchard in El Dorado County. The infected trees were destroyed and testing showed no trace of the pathogen in any other trees in the area.

A small number of infected trees have been found in native Bishop pine stands in southern coastal Mendocino County. Though Bishop pine is present in JDSF, pitch canker is not known to exist on the Forest. However, for regulatory purposes, the entire County of Mendocino, including JDSF, is within the Coastal Pitch Canker Zone of Infestation. CDF has surveyed for pitch canker by sampling trees with crown symptoms and collecting sterile water bark washings to detect spores in runoff from random stems. All samples have been negative in recent surveys (Marshall, 2002).

Pitch canker is caused by the fungus *Fusarium circinatum*. The fungus was introduced into California and occurs elsewhere in the southeastern United States. It was first detected and identified in California in 1986 in both Santa Cruz and Alameda Counties. Initial infections are usually at branch tips, causing needle wilt and tip death. The disease may also cause resinous or pitchy cankers on all woody parts of the tree. Stem cankers may girdle and kill smaller trees. Death of infected trees or their tops may result from secondary attack by bark beetles, primarily pine engraver beetles. Bark, twig, and cone beetles are associated with the spread of this pathogen.

Monterey pine (*Pinus radiata*) and Bishop pine (*P. muricata*) are the tree species most commonly infected in California. Douglas-fir (*Pseudotsuga menziesii*) has very rarely become infected in natural stands. The pathogen for pitch canker has been isolated from numerous pine species in California, and susceptibility has been determined for additional species by greenhouse tests (Table VII.6.4.3; Dallara, et al., 1995).

California native conifers that demonstrated resistance to pitch canker disease in greenhouse seedling tests are white fir (*Abies concolor*), coast redwood (*Sequoia sempervirens*), and giant sequoia (*Sequoiadendron giganteum*). Brutia pine (*Pinus brutia*), a non-native species, also showed resistance in these tests (Dallara, et al., 1995).

Table VII.6.4.3. Tree Species Found Infected With Pitch Canker Fungus in Nature, and Species Susceptible in Greenhouse Tests.

Common Name	Scientific Name
Naturally Infected Species	
Aleppo pine	<i>Pinus halepensis</i>
Bishop pine ¹	<i>P. muricata</i>
Canary Island pine	<i>P. canariensis</i>
Coulter pine	<i>P. coulteri</i>
Gray or foothill pine	<i>P. sabiniana</i>
Italian stone pine	<i>P. pinea</i>
knobcone pine	<i>P. attenuata</i>
Monterey pine	<i>P. radiata</i>
Monterey x knobcone pine	<i>P. radiata x attenuata</i>
Ponderosa pine	<i>P. ponderosa</i>
Shore pine	<i>P. contorta</i>
Torrey pine	<i>P. torreyana</i>
Douglas-fir	<i>Pseudotsuga menziesii</i>
Species Susceptible in Greenhouse Tests	
Eldarica pine	<i>Pinus eldarica</i>
Jeffrey pine	<i>P. jeffreyi</i>
Mugo pine	<i>P. mugo</i>
Scots pine	<i>P. sylvestris</i>
Sugar pine	<i>P. lambertiana</i>
¹ Bolded species are California natives. Source: Dallara, et al., 1995	

Regulatory Framework

In the case of plant diseases injurious to timber or forest growth, the Director of the California Department of Forestry and Fire Protection (CDF), with the approval of California State Board of Forestry and Fire Protection, is authorized to declare that a given geographic area is within a Zone of Infestation (Public Resources Code 4716). Where a quarantine or regulation controls the movement of host plant material within or from infested counties or a Zone of Infestation, intrastate movement is regulated by the California Department of Food and Agriculture (CDFA). In the case of interstate movement, the regulatory agency is the USDA-Animal and Plant Health Inspection Service (USDA-APHIS). The county agricultural commissioners represent both CDFA and USDA-APHIS for regulatory enforcement at the local level. CDF regulations regarding forest pests are restricted to properties under a current, approved permitted project designed to carry out commercial timber operations. Outside of such permits, CDF does not have authority to carry out enforced pest control on the Zone-defined pest unless

the Board has approved of the management strategies and a special budget has been approved for such actions.

Sudden Oak Death (SOD)

California Code of Regulations--The Oak Mortality Regulation, as Applied to State Lands.

JDSF is within the declared SOD Zone of Infestation established by the California State Board of Forestry and Fire Protection and is within the “regulated area” for SOD as designated by the California Department of Food and Agriculture. The Zone and regulated area are identical and cover all portions of the fourteen infested counties identified in the California Department of Food and Agriculture (CDFA) Section 3700 regulation (refer to the list of counties presented below, “Regulated Area”).

Federal regulations from the USDA-APHIS, and state regulations from CDFA address SOD concerns. CDFA regulations limiting the movement of host materials apply to forest management activities on JDSF including timber harvest, timber stand improvement activities, and harvest of minor forest products. Under the state regulation, host material cannot be transported from the regulated area unless accompanied by a compliance agreement. The Forest Practice Rules (FPRs) do not specifically address SOD. However wherever a Zone of Infestation applies, the FPRs [14 CCR 917.9(a)] require that mitigations be included in Timber Harvesting Plans (THPs) to prevent the spread of the infestation. The following section includes a discussion of the applicable regulations, descriptions of host material, the “free-from” protocol, what constitutes a “compliance agreement,” and management measures to prevent the spread of SOD.

A federal quarantine for *P. ramorum* was issued as an interim rule by USDA - APHIS on February 14, 2002. For more information on the Federal rule see <http://www.aphis.usda.gov/ppq/ispm/sod/>.

Host Material, the Oak Mortality Regulation. This is a California state law (Section 3700 in Title 3 of the Code of Regulations). The law defines the regulated articles (plants or plant parts) and commodities (unprocessed wood, wood products, and any other product, article, or conveyance presenting a risk of spreading the pathogen). On CDFA’s regulatory web page, with a link to APHIS’ updated (January 10, 2005) host list, 31 proven hosts and 37 associated plants (nursery stock) are now regulated as either entire plants or specific plant parts thereof. To review this list and keep abreast of updates, consult CDFA’s web site at <http://pi.cdfa.ca.gov/pqm/manual/htm/455.htm>.

Based upon currently available information, CDFA, the County Agricultural Commissioners, USDA Forest Service, and CDF have ranked the regulated articles according to their potential for transport of *P. ramorum* and believe that the highest

risk for transport is from nursery stock of host species, followed by green waste, then firewood and logs. Lumber and manufactured wood products are not considered a risk for transport of *P. ramorum*. Soil is not included in California's regulations, but is in the federal regulations. The enforcement rules are strictest for the highest risk regulated articles. Green waste is considered higher risk than firewood because the pathogen sporulates readily on leaves from tanoak, rhododendron, bay, and some other hosts. However, sporulation is rare on wood.

On JDSF, host material that is likely to be transported may consist of logs from host species produced as part of a harvest plan. In addition, there is the potential for minor forest products such as salvage sawlogs, firewood, and greenery to be moved from the regulated area.

Trained JDSF personnel will submit samples of symptomatic hosts and non-hosts to CDFA for confirmation of pathogen in new areas or on new hosts. As new hosts are confirmed by CDFA, the entire plant or specific portions thereof are amended to the rules as regulated articles. CDFA currently recognizes only RPFs, government agency personnel, and others that have been approved to attend specific CDFA-certified COMTF training as "official samplers." CDFA will use the training session attendance roster as a list of official samplers.

Only an official sampler can complete a free-from survey as discussed below. The completed free-from survey, if part of an approved THP, will allow the plan to serve as a compliance agreement for a period of one year.

Regulated Area: As of May 1, 2005, regulated counties are Alameda, Contra Costa, Humboldt, Lake, Marin, Mendocino, Monterey, Napa, San Mateo, San Francisco, Santa Clara, Santa Cruz, Solano, and Sonoma.

Distribution of SOD: Check the website <http://www.cnr.berkeley.edu/comtf/> for known infested areas. Information on local distribution may also be obtained from the County Agricultural Commissioner's office or CDF.

State Regulation: SOD can spread via host material. Therefore, plants, plant parts, unprocessed wood and wood products, and other products of the above mentioned hosts cannot be moved from counties infested with SOD without authorization by the County Agricultural Commissioner or CDF's and USDA Forest Service's harvest document approval process. The term "harvest document" refers to any document filed with the California Department of Forestry and Fire Protection that authorizes the removal of forest products for commercial purposes.

See <http://pi.cdffa.ca.gov/pgm/manual/htm/455.htm> for California Department of Food and Agriculture's (CDFA) regulations regarding commodities covered and restrictions of their movement.

Compliance Agreement. A compliance agreement is required to move regulated articles of host material from the regulated area. A compliance agreement may be obtained through the County Agricultural Commissioner's office. An inspector will complete an inspection and make a determination that all the regulations are understood, that compliance with the regulations will be achieved and that all provisions of the compliance agreement will be carried out. Once a landowner and USDA-APHIS sign a compliance agreement, the regulated host material may be moved interstate as stipulated in the compliance agreement. A compliance agreement consisting of a free-from certification is only valid in California, as APHIS does not have allowance for free-from surveys in its regulations. A THP or other "harvest document" approved by CDF may also serve as a compliance agreement. An approved harvest plan without a free-from survey, but with approved SOD mitigation covering known hosts will allow transport of host material from the regulated area. Approved plans with an incorporated free-from survey may act as a compliance agreement for a one-year period from the date of a documented negative result survey, or one year from the date of a negative reply from CDFA to samples of symptomatic hosts.

Free-from Protocol. A *P. ramorum* "free-from" survey is a survey of land with host trees or shrubs that is done to determine if *P. ramorum* is present in the area in which a commercial operation will be conducted. All survey results are good for one year, unless symptomatic hosts are observed during that year. Transects would be run designed to cover representative areas of known SOD hosts. Transect width is variable to allow for adequate inspection. The official sampler must look for symptoms on all hosts along transects (also as approaching site, etc.). CDFA's sampling protocol is to be used to confirm *P. ramorum* in the laboratory. Since the survey is to determine presence or absence, if many symptomatic trees/shrubs are found, the survey may be stopped to wait for lab results. However, if *P. ramorum* is not found, the survey will need to be completed for the entire area.

The State of California Enforcement Rules to Prevent Spread of SOD

The restrictions established by the California Enforcement Rules to Prevent Spread of SOD are summarized in Table VII.6.4.4. There are no applicable state regulations if host material from JDSF remains within the regulated area. Therefore, the following table lists regulations applicable for host material moving from the regulated area, but remaining within California.

Table VII.6.4.4. Summary Of Sudden Oak Death Woody Material Rules Under State Regulations.
Regulated articles and commodities may move from the regulated area to other parts of California if accompanied by a compliance agreement affirming the articles or commodities meet the restrictions outlines in the CDFA regulations.
Compliance agreements are issued by the local Agricultural Commissioner. Approved THPs may serve as an equivalent substitute.
Compliance agreements are valid for one year.
A "free-from" survey with negative findings can act as a compliance agreement.
If regulated stems (logs and firewood) are debarked , a compliance agreement is not needed and material is free to move.
If host stems (logs and firewood) are not debarked , a compliance agreement is needed affirming the articles have been appropriately treated.

Host material less than 4" in diameter (green waste and some special forest products, except fruits, berries and acorns). Host material from within the regulated area and smaller than four inches in diameter may move anywhere within the regulated counties. For shipment beyond the regulated counties, the site must be either surveyed and determined "free-from" and accompanied by a permit/compliance agreement, or debarked. The compliance agreement will be issued by the responsible agency (CDF or County) having jurisdiction. It is recommended that materials be taken to an approved treatment or disposal facility (i.e., cogeneration plant or compost facility), if available. Under special arrangement, infected host material may be allowed to move to an approved cogeneration facility if transported and handled according to specifics of a compliance agreement. Host material smaller than four inches in diameter, including chipped and shredded host material, shall be safeguarded during transport (such as in secured plastic bags, closed containers, or covered by a tarpaulin in such a manner that precludes the escape of any material), and otherwise handled as specified in the compliance agreement.

Restrictions on firewood and logs (host woody material greater than 4" in diameter). Firewood and logs may move from the regulated counties if accompanied by a permit/compliance agreement. The permit will be issued by the responsible agency having jurisdiction if the regulated articles have been grown on a site surveyed and determined "free-from." Regulated stems, moving as logs or firewood, do not need a compliance agreement if debarked.

Firewood sales on State forest lands. Firewood sales for host material will not be permitted in areas with confirmed cases of sudden oak death (*P. ramorum*). Personnel setting up firewood sales must know how to recognize symptoms of *P.*

ramorum. They should use the "free-from" protocol to determine if *P. ramorum* is present in the proposed firewood sale area. If *P. ramorum* is not detected in the "free-from" survey, the operation is set up as usual with no further regulation for a period of one year. For firewood permits, a provision will be added to the permit explaining the current regulations, and that compliance is required.

On State Forest lands, where the public is required to have a permit to collect firewood, CDF shall use this public contact to educate the person(s) about sudden oak death by providing a Pest Alert or other information on sudden oak death along with the firewood permit.

For Timber Harvesting Plans. If host material is to be moved intrastate from the regulated area, one of three procedures shall be followed:

1. A survey to determine the area is "free-from" *P. ramorum* is completed by Registered Professional Foresters (RPFs) or other official sampler. Symptoms of *P. ramorum* will be surveyed for during the timber cruise or pre-sale layout done to develop the Timber Harvesting Plan. If no *P. ramorum* is detected, the survey design and results may be incorporated into the plan. If the one-year free-from period expires prior to or during timber operations, a new free-from survey must be conducted and amended to the plan. Or,
2. If a free-from survey results in positive SOD finds, mitigation measures shall be written into the plan. At a minimum, mitigations shall include current regulations. In support of 14 CCR 917.9, the RPF is encouraged to add additional measures or Best Management Practices to limit the spread or build-up. Or,
3. In lieu of a free-from survey, the RPF may assume that all known SOD hosts found on the plan area are infected, and required and appropriate mitigation measures shall be incorporated.

FPR compliance: Pursuant to 14 CCR 917.9(a) for commercial harvest subject to the California Forest Practice Rules, and within the declared Zone of Infestation, the plans must identify feasible measures to mitigate adverse infestation or infection impacts during timber operations (PRC 4527).

Federal (APHIS) Enforcement Rules to Prevent Spread of SOD

Regulated articles may be transported interstate from the regulated area only if accompanied by a certificate/compliance agreement which verifies the regulated articles have been treated according to measures in the federal register. Acceptable treatments are:

1. Wood products such as firewood, logs, or lumber must be free of bark.
2. Soil (nursery industry) that has not been in contact with SOD-infected hosts and is free of duff, or soil which has been heat-treated at 180F for 30 minutes.

3. Wreaths, garlands, and greenery dipped for one hour in water held at 160F. Bay leaves used in wreaths also may be vacuum/heat treated.
4. Green waste may move to energy generation facilities under limited permits issued by the local Agricultural Commissioner.

Pitch Canker

The State Board of Forestry and Fire Protection has declared a Coastal Pitch Canker Zone of Infestation. Although described earlier, the Zone and can be checked out on the Pitch Canker Task Force website (http://frap.cdf.ca.gov/pitch-canker/prevention_management/resolution.html). CDF has authority (14 CCR 917.9(a)) to require pitch canker mitigation on the commercial harvest of host trees within the Zone.

Pitch canker is a "B"-rated disease by the California Department of Food and Agriculture. A Class B rating is for organisms of known economic importance subject to eradication, containment, control or other holding action at the discretion of the local county Agricultural Commissioner. As a result, the local or destination Agricultural Commissioner may restrict the movement of known infected host material. In the event that pitch canker becomes present on JDSF, any movement of diseased material to another county could be mitigated by the local and destination Agricultural Commissioners.

Proposed Management Measures

State Forest staff will continue to monitor the Forest for early signs of forest pests or conditions that may lead to infestation. JDSF personnel will also assist the pest-monitoring program of the California Department of Food and Agriculture by allowing deployment and inspection of gypsy moth traps in high use areas of the Forest [DFMP, Chapter 3], and SOD and pitch canker would be included as forest pests to be monitored.

Specific Management Actions

Efforts to reduce pest damage or predisposition [DFMP, Chapter 3] will include:

- The minimization of injuries to residual trees during forest management activities.
- Reuse of old skid trails where available to reduce soil compaction.
- Retention of diverse species composition in or adjacent to stands following forest management activities and within or nearby future regeneration units.

- Avoidance of non-native tree species that may be predisposed to pests with few local pest predators and parasites.
- Use of CDF or other forest pest management specialists to train employees in forest pest recognition and management.

The JDSF DFMP does not include specific Management Actions for sudden oak death and for pitch canker disease. JDSF managers and staff will comply with all elements of the regulatory framework, described above.

Thresholds of Significance

Integrated Pest Management (IPM) is a *management activity* rather than a *resource*. The impacts of IPM on environmental resources are addressed in the various resource sections when appropriate. This chapter discusses ways to minimize the impact of forest pests and diseases upon forest health.

Impacts

Generally, the impact of IPM activities upon the Forest is minimal due to the localized and sporadic occurrence of insect and plant disease outbreaks. These occurrences generally are part of the dynamics of the Forest, and do not pose a threat to the overall environment of the Forest or the surrounding area. Specific outbreaks are managed so as to minimize the negative impact to the surrounding area.

Sanitation/Salvage or other timber harvest operations would be the most likely response to a significant pest or disease outbreak on the Forest. Harvest operations would be considered a management activity of the Forest, and as such would be subject to all of the protection measures included in the Forest Management Plan. Furthermore, if the operations are a commercial operation, the activity would be subject to the FPRs and the THP review process. The protection measures in the Forest Management Plan and the environmental assessment and mitigation associated with the THP review process would reduce the potential for significant adverse environmental impacts as a result of the activity.

Pests and Diseases Known to Occur on JDSF. Black stain root disease of Douglas-fir was found to be the number one pest problem on the Forest in a 1993 tree mortality survey (Robinson, 1993). Not only were trees of all size classes killed (seedling to 47.5" dbh), but also the infected roots present a problem for reforestation. Insects also attacked a minority of the black stain-infected trees. Flatheaded fir borer (FFB) was the most common, attacking 13 percent of the infected Douglas-fir. There were many undersized Douglas-fir trees which the FFB could not attack (Marshall, 2002).

Marshall (2002) found that where FFB occurred on Douglas-fir, 80 percent of those trees had root disease (72% black stain, 10% Armillaria, with some trees having both of these diseases). Since that survey, he has observed that many more Douglas-fir trees have been killed by the Douglas-fir bark beetle following a build-up of that beetle in windthrown Douglas-fir after windstorms and saturated soil conditions in the mid-1990s,

Marshall (2002) has also observed an increase of Armillaria incidence, especially in tanoak and golden chinquapin (*Chrysolepis chrysophylla* var. *minor*), which he attributes to the extended drought and saturated conditions for a couple of succeeding years. Both tanoak and chinquapin are significant hardwood tree species on JDSF.

Diseases Known to be In the Region, but not Known to Occur on JDSF. To the south of Mendocino County, both pitch canker and sudden oak death (SOD) have caused widespread tree decline and tree mortality. Only a couple of trees have been confirmed with pitch canker in the SW corner of Mendocino County, and SOD confirmations have been limited to areas around Boonville in Anderson Valley. However, neither of these plant diseases is currently on JDSF. The scale of disease management activities in the event that either or both should move onto JDSF could vary, depending upon the level of disease incidence.

Sudden Oak Death (SOD). Tanoak is the only significant timber species on JDSF known to be susceptible to stem infections of sudden oak death. However many of the known hosts of the sudden oak death pathogen are present on the Forest. Tanoak is killed by SOD in large numbers elsewhere. Were SOD present on the Forest, the effects upon the natural resources of JDSF could be of a sufficient scale to impact Forest resources.

Pitch canker. Bishop pine is the only native species on JDSF considered being at high risk for pitch canker disease. Transplanted Monterey pines on the Forest are also at high risk. Douglas-fir is a major timber species in JDSF, but it is believed that the risk of pitch canker disease occurring in this species is small. Even where Douglas-fir is present in large numbers within mixed stands of infected Monterey pine at Año Nuevo State Reserve, pitch canker is rare in Douglas-fir.

Any Monterey pines present on JDSF are introduced plantings, and are of limited distribution on the Forest. However, Bishop pine is a major natural component of the Forest. Were pitch canker present on the Forest, management activities for pitch canker disease on Bishop pine could have significant impacts upon the natural resources of the Forest. The disease itself has the potential to impact Bishop pine populations, particularly in the coastal portions of JDSF.

6.4.2 Biological Resources

The presence of pests and plant diseases can occasionally cause numerous secondary impacts upon the botanical, timber, wildlife, and soils resources of JDSF, in addition to the primary loss of tree growth and tree mortality. Forest pest and plant disease management activities may have additional impacts upon these biological resources.

Botanical

Removal of large numbers of dead trees would suddenly change understory conditions in the immediate vicinity by altering canopy density, leaf litter composition, soil moisture, relative humidity, root competition, etc. The more site-specific understory plants may not survive such changes, and could be displaced by early seral species and some invasive weed species. In the absence of sudden mortality and tree removal, there can be expected a more gradual adjustment of understory composition through the course of stand growth and succession.

There is some site disturbance in the course of natural tree fall. Intensive cutting and disposing of stricken trees could result in trampling of vegetation, soil compaction, effects of fire, etc. However, some of this site disturbance could be beneficial to the Forest environment by creating openings for early seral species, terrestrial habitat of down woody debris, exposure of bare soil for seedbed preparation, etc.

Timber

Sanitation/Salvage is a likely management practice in diseased (i.e., black stain of Douglas-fir) or insect infested stands. Treating areas of significant pest or disease outbreak is intended to improve forest health and timber production by suppressing the pest population or spread.

Wildlife and Wildlife Habitat

Snags, down logs, hollow trees, and living trees with decay are all structural elements of the Forest used by various wildlife species. The DFMP includes specific retention standards for snags and down logs (refer to wildlife section) and has allocated a majority of the Forest to uneven-aged management and development of forest Late Seral characteristics. This management direction is intended, in part, to provide these types of structural elements across the Forest for the benefit of wildlife.

The removal and disposal of diseased or insect-infested trees can be necessary in order to prevent additional losses of trees, and associated ecosystem and commercial values, and to maintain public safety. Such activity would impact wildlife by changing the availability of shelter and food that is naturally available when trees ultimately die, become down wood on the Forest floor, and eventually return to the soil. The benefits of removal versus leaving infested and/or infected trees must be carefully considered for each situation before management activities proceed. Serious insect outbreaks have the potential to create conditions where snag or down log densities are increased to a level that threatens forest health or public safety. Forest health and public safety are of great importance, but the role of diseased, dead and fallen trees in supporting wildlife must also be considered. The management objectives for a specific site will ultimately determine to what degree retention of living trees with decay, hollow trees, snags, and logs, and living trees with brooms is permitted.

Benefits of removing dead and/or down trees resulting from severe insect or disease outbreak in a portion of the Forest could come with the ensuing shift in plant community composition. Gaps or openings support species and ecological interactions not found in closed canopy forests and would increase diversity.

In contrast, the natural progression from healthy to diseased tree, to snag, to log, to duff and finally soil organic matter provides food and shelter for a myriad of forest creatures (i.e., fungi, nematodes and worms, arthropods, reptiles, amphibians, mammals, and birds) that inhabit the Forest. For example, the formation of cavities within the decaying heartwood of beetle-killed trees is favored by cavity nesting species including woodpeckers, swifts, nuthatches, small owls, martins, flying squirrels, bats, bears, etc. Hollow trees with broken tops provide nesting opportunities for large raptors. Black-stain-killed Douglas-fir usually remain standing for a long period because the disease is a wilt, rather than a root decay. These Douglas-fir serve as snags for wildlife use for many years. The brooms in trees caused by dwarf mistletoe, rust fungi, or needle cast fungi provide nesting sites for many wildlife species, including northern spotted owls, great horned owls, great gray owls, blue grouse, goshawks, and Cooper's hawks, as well as some song birds. Dwarf mistletoe provides winter food for porcupines, chipmunks, and squirrels, as well. (Bull, Parks, and Torenson, 1997).

Geology and Soils

The burning of slash and tree stems for pest control purposes would release minerals that had previously been biologically bound back into the soil. This mineral material would be concentrated at the burn pile sites, however, rather than be returned directly to the site of origin. In addition, the organic material would no longer be available for soil organic matter, once burned.

Regulatory restrictions during wet periods may also keep traffic off of roads and minimize erosion during "saturated soil conditions."

Hazards and Hazardous Materials

The sanitation/salvage approach of treating trees killed by insects and disease should minimize the level of fuel loading due to tree mortality.

In contrast, the "no-action" approach to disease management could result in excessive fuel loading within the affected area. This is especially true in the case of SOD-infected oaks or tanoaks, which are often riddled with associative decays, contributing to early tree failure. A "no-action" approach could also further this situation by allowing the pests to continue to spread. This could subject the entire forest to an increased risk of a major forest fire.

Population, Housing, and Services

The regulatory restrictions upon public access to infested areas, movement of infested host plant material, extra permitting and inspection requirements, etc., would have a negative impact both economically and in loss of convenience for the public.

In the event of SOD presence, seasonal closure of campsites and trails in infested areas to minimize movement of the disease to disease-free areas would directly impact the public. However, such closures would be during the wet season when use of these features is typically less.

Recreation

Educational programs and distribution of educational materials to Forest visitors about SOD and pitch canker could help minimize impact on the public. These activities would raise awareness of the risks, and encourage public commitment to both regulation compliance and voluntary measures to minimize spread of the pathogen both within JDSF and more broadly.

The regulation of activities within infested areas could impact the public by possible loss of access to certain areas (roads, trails, campgrounds, etc.) during seasonal restriction.

Transportation and Traffic

The seasonal restriction of foot and vehicular traffic through infested areas could have a direct impact upon the use of certain bikeways, trails, and roads located within infested areas.

Land Use and Planning

Most Integrated Pest Management activities are intended to maximize sustained yield and enhance overall forest health. A major land use on JDSF is as a timber harvesting Demonstration Forest. Sustained production is valuable to such direction. IPM activities, including regulatory mandates or THP mitigation strategies, are designed to support, rather than adversely impact sustained production.

6.4.3 Forest Protection Mangement Measures

The intent of IPM is to attempt to prevent forest pests from causing economic or significant aesthetic or functional forest plant losses by using a variety of management methods that are cost effective and cause the least damage to the environment. IPM makes use of the benefits of cultural, mechanical, chemical, semio-chemical (e.g. synthetic pheromones), and biological pest management alternatives as well as regulatory action when necessary [DFMP, Chapter 3].

Sudden Oak Death

Recently developed information on the distribution, spread and control of sudden oak death (SOD) indicates that SOD should be directly addressed in the DFMP. Language should be included in the Forest Management Plan to address the following measures.

Infected foliage and small diameter woody material of a number of host plants present a high risk for local disease spread. Long distance spread of the disease can occur through the unintentional transport of these materials. In addition, the pathogen may be moved to new areas in clumps of soil adhered to vehicles, shoes, etc., on infested tools and equipment, and in water drafted for dust abatement or watering vegetation.

SOD management measures for timber operations are mandated on JDSF because the Forest is located within the CDFA regulated area. The SOD Zone of Infestation is geographically identical to CDFA's regulated area. SOD management measures shall include applicable state or federal regulations, and plan-preparing

RPFs shall consider incorporation of Best Management Practices (BMPs) when such inclusion limits potential build-up and spread.

A "free-from" survey can be conducted and, if no infected hosts are found, no additional management measures are required. If the survey is conducted it must be conducted by an RPF or other approved person that has attended training for survey and sampling, and is certified as an official sampler, and the plan must explain how the survey was conducted as explained in the training. An approved THP with an included "free-from" survey design and certification acts as the compliance agreement.

- Currently there is no provision that allows moving any host stems out-of-state under the federal regulations without removing all bark prior to shipment of unprocessed wood products from the regulated area.
- If a "free-from" survey is not conducted, or is conducted and *P. ramorum* presence is confirmed, all hosts are assumed to be infected and all SOD management measures, whether they be mandated regulations or recommended BMPs (as discussed below) shall be included in approved harvest documents. Management measures shall be discussed during the on-site RPF-LTO meeting prior to commencement of timber operations (14 CCR 1035.2).

Best Management Practices for SOD

Research indicates *P. ramorum* is most active, and sporulates easily, under cool, moist conditions. Spores and/or infected host material may be trapped in soil and transported, or introduced into new areas. Spores may be recovered from rain splash beneath or adjacent to infected hosts, from surface runoff in infected areas, from watercourses flowing from infected areas, and from standing water collected in infected drainages. Spores may also be collected from the bottoms of shoes and from tools/equipment used in infected areas.

1. To this end, operations should be tailored or conducted to avoid situations that foster the above scenarios. Forest Staff or contractors should complete inspection of loads of logs and equipment leaving infected sites to ensure that no host material is being transported without a permit. Host branches and foliage should be removed from the load prior to leaving the landing.
2. Forest Staff or contractors may require cleaning dirt or mud from vehicles, equipment, and shoes to reduce the risk of transporting host plant material embedded in the dirt or mud. Dust on vehicles is not considered to be a habitat or risk for spreading *P. ramorum*.
3. The information as to where and what is being removed, how it will be transported, specifically where it will be moved to, and during what time period should be included in the harvest plan if the plan will act as the compliance agreement.

4. If some sites in the general operating area are found to be disease-free or have a low incidence of disease, initiate and complete operations on these sites before moving to more heavily infested sites.
5. To the extent practical, locate landings, log decks, logging roads, tractor roads, and other sites of equipment activity away from host plants in areas with disease symptoms. Route equipment away from host plants in areas with disease symptoms. To reduce the risk of contaminating logs, don't use stem-infected hosts as bump trees.
6. In addition to following California Department of Fish and Game (CDFG) drafting guidelines (intake mesh size, etc.), water should not be drafted from a watercourse downstream of a SOD-infected area and used in an uninfested area. This is because sporangia from infected leaves (or minute parts of infected leaves), retrievable in watercourses, could be suctioned in the draft and transported to new areas. Infection could be possible if abatement overspray landed on susceptible hosts. Consider alternative dust abatement materials or strategies in lieu of drafting from infected drainages.
7. Because wet soil and mud will readily adhere to vehicles, equipment, and boots: conduct operations during the dry season. Utilize paved and rocked roads and landings to the extent possible.
8. After working in an infested area, remove or wash off accumulations of soil, mud, and organic debris from shoes, boots, vehicles and heavy equipment, etc. before traveling to an area that is not infested with SOD. Consider establishing an equipment power wash station.

The station should be:

- located within the generally infested area
 - paved or rocked
 - well-drained so that vehicles exiting the station do not become recontaminated by the wash water
 - located where wash water and displaced soil does not have the potential to carry fines to a watercourse (see "Saturated Soil Conditions" in 14 CCR 895.1)
 - pay particular attention to sites where soil and organic debris may accumulate.
9. Tools, equipment, and bottoms of shoes should be cleaned of debris and sanitized with disinfectant, such as Lysol[®], prior to leaving the infected site.
 10. Certain sets of shoes, gloves, and tools may be designated for use in SOD areas only. A separate set can be assigned to use elsewhere.
 11. Although AGRI-FOS is now registered for use on stems of tanoak and oaks to systemically act as a fungistat, retarding stem canker growth, such use is not practical or warranted on a forest-wide basis. This chemical should be used only to protect or prolong the lives of high value trees.

12. Since SOD infected trees often have additional stem decays and structural deterioration from the wood boring galleries of attacking ambrosia beetles, work sites should either be positioned away from such potentially hazardous trees or the proposed work site should be cleared of such trees prior to operations.

Recommended Measures, Should Pitch Canker Be Identified On JDSF Lands.

The timely removal and disposal of trees declining from pitch canker may help prevent the buildup of destructive beetles which can attack other trees, and can subsequently carry the pitch canker pathogen to uninfected trees.

The disposal of pitch canker diseased material should be done on-site so as not to spread the disease to uninfested areas. Limbs and small pieces of wood may be left on-site or they may be chipped or burned.

Logs cut from pitch canker diseased trees may be split for firewood for local use, but the wood should be seasoned beneath a tightly sealed, clear plastic tarp to prevent the buildup of destructive insects. California Department of Forestry and Fire Protection Tree Note #3, *Controlling Bark Beetles in Wood Residue and Firewood*, provides specific guidelines for placing tarps over and around firewood. Do not stack pine firewood next to living pine trees or transport it to uninfested areas (Sanford, 1996).

The distribution of the disease is discontinuous and thus there are infested as well as uninfested areas within the Zone of Infestation. At the time this document was prepared, pitch canker was not known to occur on JDSF. The Pitch Canker Task Force of the California Forest Pest Council and CDF have on-going monitoring underway for the disease. JDSF staff should sample and report any symptomatic hosts to CDFA's plant pathology lab in Sacramento. CDF and the Mendocino County Agricultural Commissioner shall be notified immediately in the event that pitch canker is found on JDSF.

Directions for Registered Professional Foresters and Licensed Timber Operators

1. Know when you are working within an infested area.
2. The California Department of Forestry and Fire Protection (CDF) has the authority to impose conditions on the commercial harvest of trees from timberland within the Zone of Infestation. Such actions are to be carried out on a case-by-case basis and depend upon the harvest operation's potential to contribute to disease spread. For all timber operations regulated by the Department, the Department must be informed if pitch canker is present within the operating area, and the RPF shall propose mitigations (14 CCR 917.9(a)).

3. Do not transport infected or contaminated material to areas that are free of the disease.
4. When cutting or pruning a diseased tree, clean tools with a disinfectant before reusing them in uninfested areas. Lysol® is an effective sterilizer. Make sure that clients and coworkers are aware of these guidelines (Pitch Canker Task Force, 2000a).
5. Pine engraver beetles are often the tree-killing agent for pitch canker infected trees. Trees that otherwise may survive pitch canker infection can succumb to mass attacks of the bark beetle. Any mitigations for the proper management of pine brood material (14 CCR 895.1) to avoid build-up of pine engraver beetles are recommended.
6. JDSF personnel should be kept informed whether pitch canker is determined to be present on the Forest. Any suspect areas shall be avoided for firewood harvest until an official determination is made as to presence or not of the disease. At time of firewood permit issuance, JDSF personnel shall direct firewood cutters to disease-free areas of the Forest. Information on pitch canker disease recognition and regulations shall be provided with the collection permit in the event that pitch canker becomes present on the Forest.
7. Tools and machinery that are to cut trees with pitch canker disease WILL BECOME CONTAMINATED with the pitch canker fungus. There is little chance of spreading pitch canker if contaminated tools are only used on dead trees or on trees that are not pines. However, if contaminated tools or machinery will be used on living pines, the tools should be cleaned and sterilized before reuse on uninfected trees or in uninfested areas. Lysol® is a sterilizer. A logical alternative to repeated cleaning of equipment is to reserve one set of equipment for use only in infested areas, and another set for use only in uninfested areas.
8. Do not transport pine firewood out of infested counties (Mendocino County is an infested county). Sell or consume pine firewood locally (Pitch Canker Task Force, 2000a).

Directions for Other Forest Product Harvesters

JDSF personnel, at time of collecting permit issuance shall direct collectors to disease-free areas of the Forest. Information on pitch canker disease recognition and regulations shall be provided with the collection permit.

Collectors shall not be permitted to remove pine products from trees infested with pitch canker disease.

Directions for Reforestation in Areas Affected by Pitch Canker

Material for replanting should be as local in origin as possible to retain the genetic integrity of the local population (Pitch Canker Task Force, 2000b).

Option 1. The preferred strategy for reestablishing Bishop pine would be to allow natural regeneration to occur. Site improvement to encourage regeneration may be required where a dense overstory precludes the development of a seedling stand. Where natural regeneration does occur, it can be expected that pitch canker will eventually infect some or most of the young trees. However, the trees will vary in their susceptibility and some may sustain little or no damage. This is the least intrusive approach to reforestation, with the possibility that a level of pitch canker resistance will be attained that eventually provides the desired density of mature trees (Pitch Canker Task Force, 2000b).

Option 2. If option one is acceptable in principle but there is insufficient seed to produce a stand, locally collected seed could be introduced. By collecting seed from asymptomatic trees, there is more likelihood that some are resistant, and a certain percentage of the progeny will carry this trait as well. It is thought that a small percentage of resistant individuals may be sufficient to establish a stand. To diversify the seed source, it is recommended that seed be gathered from: 1) multiple trees, at least 100 meters apart where possible, 2) trees of differing ages, and 3) different heights within the same tree. Trees that have been planted should be avoided, as they may be non-local in origin. In addition, trees with evidence of disease or poor health should not be used as a seed source (Pitch Canker Task Force, 2000b).

Option 3. The least desirable measure for maintaining Bishop pine presence is to transplant known resistant seedlings from a reputable source. The potential loss of genetic integrity could result in a nonnative stand (Pitch Canker Task Force, 2000b).