



United States Department of Agriculture
US Forest Service
Natural Resource Manager (NRM)



FSVeg Common Stand Exam User Guide Root/Butt Diseases (Category 21)

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INTRODUCTION

Root diseases can be difficult to detect. Diagnosis is usually done by a combination of stand-level and tree-level characteristics. Stand indicators include:

- Openings or gaps in the overstory, openings may be filled with shrubs, hardwood trees, or root disease-resistant species
- Pockets of mortality include down, broken, recent dead, and other dead trees in proximity to each other
- Wind thrown trees with rotted root system "root balls"

Tree-level indicators include:

- Live trees with crown symptoms including yellow or chlorotic foliage, shortened leaders and internodes, distress cone crops
- Resin exudes from roots and root crowns, often accompanied by fungal structures, stain, or decay
- Trees have been or are currently being attacked by bark beetles, especially the Douglas-fir beetle and the fir engraver
- Stumps with characteristic decay, presence of thick mycelial fans originating from roots, or fungal fruiting bodies
- Root rot fungi seldom show their fruiting body

(21-001) ARMILLARIA

Species: *Armillaria* spp.

Host: Douglas-fir, grand fir, white fir, subalpine fir, western white pine, ponderosa pine, limber pine, western hemlock, Englemann spruce, western larch, western redcedar

Range: Transcontinental

Injury: Basal resins are often seen on the outside of bark at the root crown. Mycelial fans are generally present beneath the bark at the root crown; these fans are cream to white, 1/16-1/4" thick, with fanlike, radiating ridges. The stringy yellow-white sapwood decay is often not sufficiently advanced at the root crown for proper diagnosis. Black zone lines traverse the decay in irregular patterns and aid considerably in identification of early decay.

Description:

Fruiting bodies are honey-colored mushrooms that grow 3 to 10 inches tall, appearing in the fall. Rhizomorphs (dark brown or black, flattened strands of fungal tissue) sometimes can be found growing along root surfaces or through soil.

Use presence of thick, white mycelial fans (or impressions of fans in older decay) originating on roots or at the root collar for positive identification. Fans should peel like latex paint and be substantial enough that they do not “disappear” when scraped or pulled off. Resin-flow may be present. (Saprophytic forms of Armillaria produce “wimpy” mycelial fans that do not leave impressions in the wood. Resin flow is not associated with saprophytic Armillaria). Rhizomorphs alone are also not enough to positively identify the disease. Use caution when identifying suspected infected intermediate and suppressed trees when associated co-dominant and dominant trees do not appear to be infected. When identifying Armillaria root disease in stumps, it is important to associate suspected infected stumps with mortality of surrounding trees.

Defect:

Decay extends into the base 2-5 feet.

Figure 1: Mycelial fans under bark



Figure 2: Mushrooms on roots



Figure 3: Advanced decay



Figure 4: Rhizomorphs between bark and woods



(21-002) YELLOW STRINGY ROT

<u>Species:</u>	<i>Corticium galactimum</i>
<u>Host:</u>	Balsam fir, subalpine fir, tamarack, white spruce, black spruce, red spruce, red pine, eastern white pine, sycamore, Douglas-fir, white oak, chestnut oak, black oak, live oak, and western redcedar
<u>Injury:</u>	Causes a yellow butt and root rot. The crust like, cream-colored sporophores on roots and logs may grow out over adjacent soil and debris.

(21-003) CYLINDROCLADIUM ROOT DISEASE

<u>Species:</u>	<i>Cylindrocladium spp.</i>
<u>Host:</u>	Eastern white pine, red pine, Scots pine, Norway spruce, white spruce, black walnut
<u>Secondary host:</u>	Austrain pine, sweetgum, oak
<u>Range:</u>	Lake States and in eastern and southeastern states
<u>Injury:</u>	The fungi over winter as hardy “resting” spores, then attack young, newly planted seedlings. It may kill seedlings as they sprout from seed or cause root rot in young seedlings. When conifers are attacked, the foliage shrivels and turns red. The foliage of hardwoods turns yellow and then a reddish brown. The roots of conifer and hardwood seedlings turn black when infected, and the outer bark will loosen and crack.

(21-004) BROWN CRUMBLY ROT

Species: *Fomitopsis pinicola*

Host: Western larch, Douglas-fir, Englemann spruce, Sitka spruce, white spruce, black spruce, red spruce, bigleaf maple, yellow birch, hickory, lodgepole pine, ponderosa pine, jack pine, pinyon pine, limber pine, sugar pine, singleleaf pinyon, eastern white pine, balsampoplar, black cherry, northern white cedar, western redcedar, incense cedar, Alaska yellow cedar, mountain hemlock, western hemlock, boxelder, noble fir, Pacific silver fir, white fir, subalpine fir, California red fir

Range: Northern and western states

Injury: This rot is associated with old-growth stands of fire-damaged larch, and causes the wood to become dark reddish-brown and cubically cracked. If the fungus is present within a timber stand, suspect or risk trees are those with broken tops or large broken branches.

Description: Thick mats of cream-colored mycelium are very conspicuous in the cracks. The conks often appear in the upper portions of the tree and on the ground under the tree where they have broken off and fallen. They can be up to 24 inches long and 10-12 inches wide. They are pendulous or hoof-shaped and chalky in color.

Defect: Decay on an end-section or the presence of a conk imply total loss of the heartwood, and in dead logs, total cull of all wood.

Figure 5: Cross section

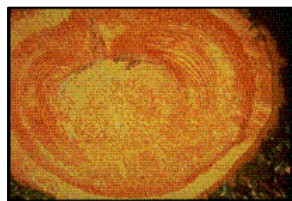


Figure 6: Crumbly rot in woods

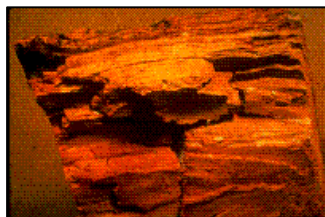


Figure 7: Conk on tree



Figure 8: Two conks, one with the “red belt” on upper surface



(21-005) BLACK ROOT ROT OF PINE

<u>Species:</u>	<i>Fusarium oxysporum</i>
<u>Host:</u>	Jack pine, shortleaf pine, Jeffery pine, sugar pine, red pine, Douglas-fir, silver maple, Sitka spruce
<u>Injury:</u>	This is mainly a seedling or nursery disease. Leaf browning, root rot, and stunting. The leaf tips first become yellow, and eventually the whole plant becomes brown, while the root cortex becomes brown and eventually black. The cortex will slack off leaving the vascular cylinder, which also turns brown, sometimes with red patches.

(21-006) BLACK KNOT OF CHERRY

<u>Species:</u>	<i>Apiosporina morbosa</i>
<u>Host:</u>	Black cherry
<u>Injury:</u>	Irregular swellings on black cherry stems, branches, and twigs. Often a white fungus is found growing over the swellings. Later, the swellings blacken and appear rough.
<u>Description:</u>	Swellings on the branch of the host plant are covered with an irregular, rough, fruiting layer of fungal tissue. Spore bearing fruiting bodies form within this fruiting layer.

(21-007) WHITE MOTTLED ROT

<u>Species:</u>	<i>Gandoderma applanatum</i>
<u>Host:</u>	Aspen, paper birch, western hemlock
<u>Injury:</u>	Rot occurs in sapwood and heartwood not far above stump height. Wood is light, mottled, soft, and spongy with fine black zone lines. This rot often produces wind thrown trees, with rotten stumps, often in groups.
<u>Description:</u>	Sporophores are large, shelf-like conks, with smooth, grayish, zoned upper surfaces, and a lower surface with small white pores that turn brown when bruised. The conks are usually found at the base of infected trees.

Figure 9: Conk on paper birch



(21-008) GANODERMA ROT OF HARDWOODS

<u>Species:</u>	<i>Ganoderma lucidum</i>
<u>Host:</u>	Oak, maple, ash, sweetgum, locust, elm, honey locust, willow
<u>Range:</u>	Southern states
<u>Injury:</u>	Affected trees usually show a rapid decline, evidenced by shortened twig growth, off-color foliage, dwarfed and sparse foliage, and branch dieback. The rotten roots are white and spongy, with black flecks or dark lines.
<u>Description:</u>	Conks are produced at the butt or on exposed roots of affected trees. They have a stem, the tops are reddish to buff-colored, and the white undersurface is porous. Conks are tough, woody, and persistent.

Figure 10: Ganoderma rot of hardwood



(21-009) GANODERMA ROT OF CONIFERS

<u>Species:</u>	<i>Ganoderma tsugae</i>
<u>Host:</u>	Western hemlock
<u>Range:</u>	Southeast Alaska
<u>Injury:</u>	This fungus does not grow on live trees, and is not common.
<u>Description:</u>	Upper surface of conk is distinctly varnish- or lacquer-like and shiny reddish brown. Lower surface is white. Conks may be several centimeters to half a meter wide and are attached by a lateral stalk. Decayed wood is wet, soft, straw colored, and may have black spots scattered throughout. Red-brown zones may be present in decayed wood. Conks are generally found on large, old stumps or logs that have been down for a considerable number of years.

Figure 11: Conk on old hemlock log



(21-010) ANNOSUS ROOT DISEASE

<u>Species:</u>	<i>Heterobasidion annosum</i>
<u>Host:</u>	Grand fir, white fir, Pacific silver fir, subalpine fir, Douglas-fir, Sitka spruce, mountain hemlock, western hemlock, western redcedar, ponderosa pine, western white pine, lodgepole pine, red pine, loblolly pine, shortleaf pine
<u>Injury:</u>	Crown symptoms may be produced although not as often as with other root diseases. Best identification comes from presence of fruiting bodies. Conks are often produced inside stumps. (Tear apart “soft” stumps. Look for conks in hollows, between bark and wood, or at the heartwood/sapwood interface.)
<u>Description:</u>	Conks are occasionally produced at the base of dead trees under the duff. Two types of conks may be found. Shelf conks have a brown to black, leathery to woody, smooth upper surface. The pore layer is cream to white with rounded, regular pores. A white “sterile” margin can be found at the conk edge (looks like pore layer but without pores). Button conks appear to be small pustules (popcorn-like) of white-cream to light brown fungal material. Pores should be visible. They are often found under the soil on roots or in root crotches. Advanced decay delaminates the wood (comes apart at the annual rings). Pitting often occurs on one side of the laminate. White fibers with black flecks are associated with wood in less advanced stages of decay. Identifying annosus root disease by incipient decay (reddish-brown stain) is unreliable. Use advanced decay and fruiting bodies for positive identification. Bark beetles are often associated with this root disease, particularly when it occurs in white or grand fir.
<u>Defect:</u>	Conks on older trees indicate 8-10 feet of cull in the lower stem.

Figure 12: Stringy rot



Figure 13: Windthrown



Figure 14: Transmission

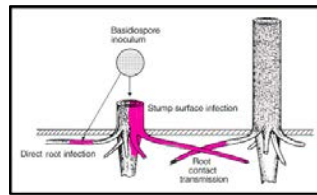


Figure 15: Transmission



(21-011) BROWN CRUMBLY ROT

Species: *Inonotus circinatus*

Host: Slash pine, shortleaf pine, sand pine

Range: Southern states

Injury: Infected trees appear thin crowned, with dwarfed, yellow needles. As the disease progresses, wind-throw becomes common. Infected roots show a dark, reddish-brown stain. Resin often impregnates stained wood and exudes through the bark at the base of the tree. Roots with advanced decay have small, elliptical pockets filled with white mycelium.

Description: The fungus produces fruiting bodies in the fall and winter on the bases of affected trees and from infected subsurface roots. Fruiting bodies are firm-textured and yellowish-brown, and can be bracket-shaped or have a well-defined stem. The lower surface of the fruiting body is composed of many pores.

(21-012) TOMENTOSUS ROOT DISEASE

<u>Species:</u>	<i>Inonotus tomentosus</i>
<u>Host:</u>	Englemann spruce, Douglas fir, ponderosa pine, eastern white pine, western white pine, white spruce, Sitka spruce, black spruce, tamarack
<u>Injury:</u>	It is difficult to identify unless associated with wind thrown or dead trees. Very common root and butt rot of spruce. It starts as a dark reddish brown discoloration followed by formation of elongate pockets separated by brown or reddish firm wood. The edges of pockets are distinct. A cross-sectional view looks like a honeycomb.
<u>Description:</u>	The conk is small, 1-2 inches, and indistinct. The upper surface is brown and hairy. It has a central stalk with a white tube layer continuing down from the cap. The conk quickly turns brown and decays.
<u>Defect:</u>	Decay extends, as a cone, six to 10 feet into the butt log.

Figure 16: Tomentosus root disease

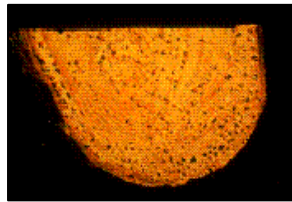


Figure 17: Tomentosus root disease

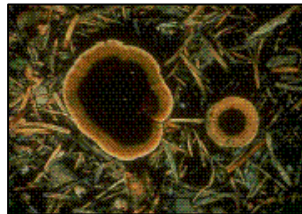


Figure 18: Leathery annual fruiting body



Figure 19: Honeycombed advanced decay of spruce roots



(21-013) CHARCOAL ROOT ROT

<u>Species:</u>	<i>Macrophomina phaseolina</i>
<u>Host:</u>	Douglas-fir, red fir, white fir, giant sequoia, sugar maple, silver maple, white spruce, Norway spruce, Arizona cypress, black locust, sand pine, Coulter pine, shortleaf pine, slash pine, Jeffery pine, sugar pine, ponderosa pine, Monterey pine, Scots pine, loblolly pine
<u>Injury:</u>	It is one of the most important diseases in forest nurseries. The causal fungus exists in the soil as small black dormant structures called sclerotia. As seedling roots grow and encounter the sclerotia, they germinate; the fungus penetrates the root gradually killing the root system. The seedlings are then stunted and they die. New sclerotia formed between the bark and wood of dead roots provides a diagnostic sign to distinguish this disease from other root diseases of western conifers. In addition to seedling losses in the nursery from mortality and culling of stunted stock, infected seedlings planted in warm soils also may be killed by this fungus.

(21-014) BLACK STAIN ROOT DISEASE

<u>Species:</u>	<i>Ophiostoma wagneri</i>
<u>Host:</u>	Douglas-fir, ponderosa pine, lodgepole pine, eastern white pine, western hemlock
<u>Secondary host:</u>	Western white pine, mountain hemlock, pinyon
<u>Injury:</u>	Crown symptoms are described above. Distinct vertical black streaks in root and root crown sapwood follow annual rings.
<u>Description:</u>	Black stain can be distinguished from blue stain by the pattern of stain: black stain follows the annual rings while blue stain produces wedge-shaped stain areas that point inward toward the pith. Cut into root or base of bole to observe pattern of stain in sapwood if black stain is suspected. This disease is often associated with beetle infestations. It does not produce decay. Bark and sapwood may be soaked in resin.

(21-015) SCHWEINIZII BUTT ROT

Species: *Phaeolus schweinitzii*

Host: Pacific silver fir, balsam fir, white fir, subalpine fir, California red fir, noble fir, incense, Port Orford, Atlantic white cedar, tamarack, western larch, Norway spruce, Englemann spruce, white spruce, black spruce, red spruce, Sitka spruce, whitebark pine, knobcone pine, jack pine, sand pine, lodgepole pine, shortleaf pine, pinyon pine, slash pine, limber pine, Jeffery pine, sugar pine, singleleaf pine, western white pine, longleaf pine, ponderosa pine, Table Mountain pine, Monterey pine, red pine, digger pine, pond pine, eastern white pine, Scots pine, loblolly pine, Virginia pine, Douglas-fir, Pacific yew, Northern white cedar, western redcedar, western hemlock

Injury: This fungus causes a dry and brittle brown cubical rot in the heartwood and roots of conifers. Douglas-fir beetles or Armillaria root rot in mature Douglas-fir are often indicators of this rot. When these are present look for small roots near the root crown; cut into the heart of these roots and look for a red resinous interior. Look for basal scars with carpenter ants or with cubical or powdery brown decay. Wind thrown trees may have root galls caused by this rot, which are especially obvious on main roots that are stubbed and callous.

Description: On soil, the conks are circular with a sunken center and thick, short, central stalk; on boles, the conks are thin brackets. The upper surfaces are velvety and dark reddish-brown in color, while the undersides are yellow-green with a creamy margin when fresh and dark red-brown when old. One to two conks per acre indicate 40% of all trees are infected; four to six conks per acre indicate 60% of all trees are infected; more than six conks per acre indicate 60-100% of all trees are infected.

Defect: A conk in or near a tree or decay in the butt indicates 8-12 feet of tapered decay in the first log. However, if carpenter ants are present, decay will extend to 32 feet. In very dry areas, the decay often extends to 32 feet without ants.

Figure 20: Older fruiting body



Figure 21: Longitudinal section

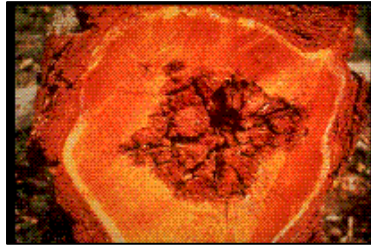


Figure 22: Fungus at base of tree



Figure 23: Fungus at base of tree



(21-016) FLAME TREE ROOT DISEASE

Species: *Phellinus noxius*

Host: Flame tree, ironwood, mango, kapok, cocoa, coffee, tea

Range: Pantropical, Pacific Islands, and Hawaii

Injury: The most obvious symptom is the presence of a brown crust of the fungus at the base of the tree trunk. As the crust develops, it can surround the whole tree base and may reach up to about one meter in height. The wood underneath the crust turns brown. Affected tree roots are covered by a dark brown crust to which soil particles are attached, giving a rough surface. As the roots become infected, the branches begin to die back. By the time the crust is visible on the trunk, the tree starts losing leaves and branches die back. Eventually the tree dies.

Description: The fungus rarely produces spore bearing or sexual reproductive structures. The fungus is spread by thick fungal strands, which grow in the soil from infected roots of dead trees.

(21-017) LAMINATED ROOT ROT

Species: *Phellinus weirii*

Host: Douglas-fir, mountain hemlock, grand fir, white fir, subalpine fir, western hemlock, western larch, Englemann spruce, western redcedar

Range: Northwestern states and Alaska

Injury: Crown symptoms are described above. A thin layer of white to cream or buff-colored (sometimes fuzzy) mycelium on the outside of roots is a good indicator of disease on younger trees (use in plantations). In advanced decay, growth rings delaminate (separate) into sheets, and small pits 3/4th of an inch) are visible on both sides of the rings. Decay of root sapwood and butt heartwood is rapid and characteristic.

Description: Rusty-reddish colored “whiskers” (fungal hairs) are visible in small patches or larger “velvety” clusters, visible between separated sheets of decayed wood. Identify laminated root rot based on a combination of delaminated wood, pitting, and presence of reddish whiskers. The fungus causes the wood to separate along the annual rings in the form of a definite ring shape. It is yellow-brown, stringy, and riddled with small pockets. Sporophores are dark brown or yellowish-brown conks appearing as thick sheets on bark, often cracked with age.

Defect: Heart rot of the stem often resulting in total cull.

Figure 24: Crown decline and stubbed roots

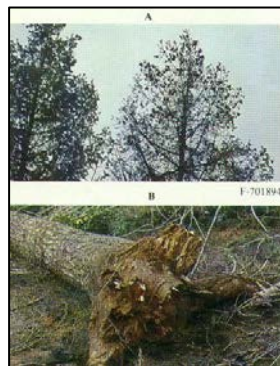


Figure 25: Brown stain and advanced decay



Figure 26: Laminated decay of western red cedar



(21-018) PHYTOPHTHORA ROOT ROT

<u>Species:</u>	<i>Phytophthora cinnamomi</i>
<u>Host:</u>	Fraiser fir, red maple, Port-Orford cedar, black walnut, juniper, incense cedar, tanoak, Norway spruce, blue spruce, jack pine, sugar pine, Table Mountain pine, red pine, eastern white pine, Scots pine, Douglas-fir, white oak, black locust, western hemlock
<u>Injury:</u>	Causes a seedling root disease, mostly in nurseries and plantations. It requires warm, moist soil.

(21-019) LITTLELEAF DISEASE

Species: *Phytophthora cinnamomi*/Pythium

Host: Shortleaf pine, loblolly pine

Secondary host: Virginia pine, pitch pine, slash pine, longleaf pine

Range: Southeastern states

Injury: The first symptoms are nutrient deficiency: a slight yellowing and shortening of the needles and reduction of shoot growth. In the later stages of the disease, the symptoms become progressively more distinctive. The crown of an infected tree appears thin and tufted. New needles are discolored and shorter than normal, and the tree loses all but the new needles near the tips of the branches. Branches begin dying, starting in the lower crown and progressing upward through the crown. During this time, the tree's diameter growth is markedly reduced. About 3 years before death, diseased trees commonly produce abundant crops of small cones. Most of the seeds in these cones are sterile. Littleleaf killed trees can often be recognized by these undersized cones, which remain attached to the branches.

The disease infects the rootlets of susceptible trees. If the soil has low nitrogen and poor internal drainage, the disease results in rootlet mortality. The effects of the disease are often made worse by the activity of nematodes and species of the fungal genus, *Pythium*, which also attack the rootlets.

Figure 27: Distribution



Figure 28: Infected short leaf pine



(21-020) PORT-ORFORD-CEDAR ROOT DISEASE

Species: *Phytophthora lateralis*

Host: Port-Orchard-cedar, Pacific yew

Injury: Infected trees decline rapidly, with crowns fading from yellow through red and brown. This fungus grows from the roots up through the root crowns and lower stems. Infected phloem is stained cinnamon-brown.

Figure 29: Inner bark infected and discolored



Figure 30: Infected young stand



(21-022) PYTHIUM ROOT ROT

Species: *Phythium spp.*

Host: All plants, especially seedlings in nurseries

Injury: This is a major cause of damping off in nurseries. It attacks the roots of seedling early in the season. These fungi are common in field soil, sand or sediment of surface water supplies, and dead roots of previous crops. Pythium is easily introduced into pasteurized soil or soilless mixes by using dirty tools, dirty pots or flats, walking on or allowing pets to walk on the mixes and by dumping the mixes on benches or potting shed floors that have not been thoroughly cleaned. Pythium can cause severe root rot because it has few competitors to check its activity. This fungus poses a threat to crops grown in ebb and flow systems. If the reservoir is heavily contaminated with debris or soil harboring Pythium, the fungus can spread to a large number of plants quickly. Root tips, which are very important in taking up nutrients and water are attacked and killed. Pythium also can rot the base of unrooted cuttings.

Symptoms include: plants are stunted, root tips are brown and dead, plants wilt at mid-day and may recover at night, plants yellow and die, rot may proceed up the stem, brown tissue on the outer portion of the root easily pulls off leaving a bare strand of vascular tissue exposed, the cells of roots contain many microscopic thick-walled spores.

(21-023) PROCERA ROOT DISEASE OF CONIFERS

Species: *Verticicladiella procera*

Host: Eastern white pine

Secondary host: Jack pine, red pine

Range: Montana, Ohio, Indiana, Maryland, Pennsylvania, West Virginia, Vermont

Injury: Affected, mature white pines may die from the top down, one whorl at a time. Older and younger trees alike may also turn yellow and lose some needles before turning brown uniformly. Some trees may die within a year after symptoms appear. Others may linger for several years, with mortality occurring apparently at random, and 1 to 3 percent of the affected trees dying annually. A chocolate-brown to dark olive-brown canker may occur under the bark around the root collar. However, cankers are not always present, and tree death may result from the killing of numerous small roots 1/16 inch in diameter and smaller.

Description: Fruiting bodies associated with this fungus cannot be seen with the unaided eye. However, the fungus can be readily identified when grown in pure cultures and observed under a microscope.

(21-024) CROWN GALL

<u>Species:</u>	<i>Agrobacterium tumefaciens</i>
<u>Host:</u>	Redwood
<u>Secondary host:</u>	Incense cedar, black cottonwood, silver maple, persimmon, Rocky Mountain juniper, and giant sequoia
<u>Injury:</u>	Large galls up to 20 cm across are found on the branches.
<u>Description:</u>	It is a soil saprophyte and wound parasite, with one polar flagella. It is rod shaped, 1-3 X-.4-.5 um in size.

(21-025) BOREALIS CONK

<u>Species:</u>	<i>Climacostis borealis</i>
<u>Host:</u>	Sitka spruce, western hemlock, mountain hemlock
<u>Range:</u>	Southeast Alaska
<u>Injury:</u>	Causes a white mottled wood rot of living trees and continues decay in wood of dead trees.
<u>Description:</u>	Fruiting body is annual, shelving, white, and fleshy. Upper surface is shaggy. Lower surface has large pores. Decayed wood is yellowish white and shows white flecks in cross section. Tangential and radial faces have white patches around pinholes and cross-grain white streaks. Thoroughly decayed wood fractures in a cubical pattern.

Figure 31: Borealis conk



(21-026) YELLOW PITTED ROT

<u>Species:</u>	<i>Hericium abietis</i>
<u>Host:</u>	Englemann spruce, Sitka spruce, western hemlock
<u>Injury:</u>	The rot may develop in the butt or upper portions of living trees, or in stumps, fallen trees, and snags. The coral fungus probably enters living trees through wounds and dead branches. The color of the wood does not change noticeably.
<u>Description:</u>	The fruiting bodies are soft, creamy white, coral like, and characterized by the presence of numerous “spines” or “teeth” which produce spores. The fruiting bodies are short lived and not readily recognized when shriveled and dry.

Figure 32: Yellow pitted rot



(21-027) BROWN CUBICAL ROT

<u>Species:</u>	<i>Laetiporus sulphureus</i>
<u>Host:</u>	California red fir, white fir, spruce, hemlock, cottonwood, poplar
<u>Injury:</u>	The fungi leave a more or less fibrous or stringy residue, which may be tan, white, or brownish. Conks may or may not be present, are distinctly shelving, large, and bright yellow on the lower surface and interior. The upper surface is bright orange. As the decay progresses, effected wood is often reduced to a wet, pulpy mass. Later this wood may be destroyed, leaving a hollow in the tree.
<u>Defect:</u>	A conk indicates total cull of most logs. Decay on a log end extends as a column throughout the log.

Figure 33: Old dead fruiting bodies



Figure 34: Fruiting bodies

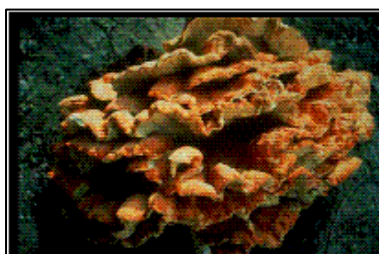


Figure 35: Fruiting bodies



(21-028) SUDDEN OAK DEATH

Species: *Phytophthora spp.*

Host: Tanoak, coast live oak, black oak

Secondary host: Huckleberry, madrone, bay laurel, California buckeye, bigleaf maple, honeysuckle

Range: California, Oregon

Injury: The fungus-like organism invades susceptible trees through the bark, producing bark cancers and killing portions of the tree. This creates an ideal environment for insects and other fungi to invade. Woody shrubs are invaded through the leaves or the bark.

Description: Caused by *Phytophthora ramorum*, a newly described member of this genus. The origin of *P. ramorum* is presently unknown.