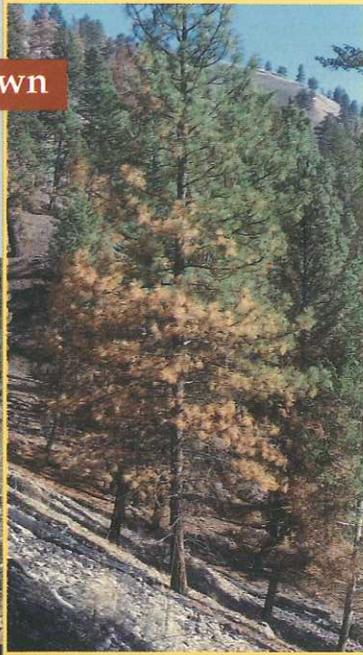
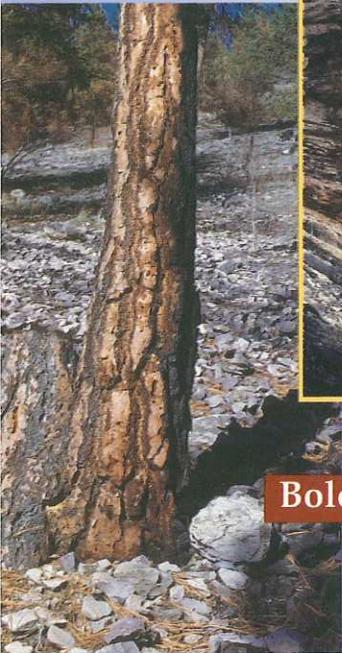


Ponderosa Pine Survivability Is Determined By Amount Of Damage To:

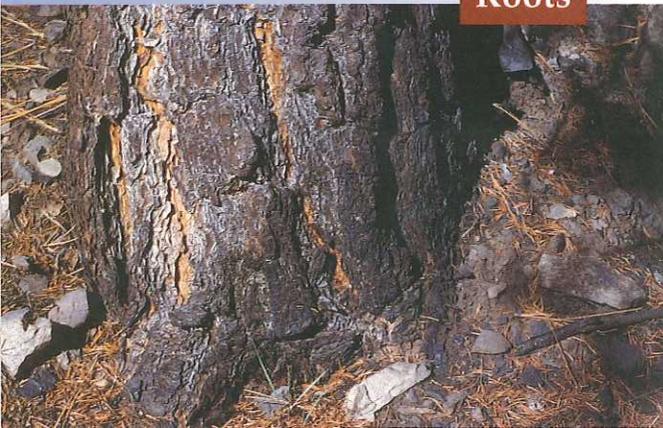
Crown



Bole (Trunk)



Roots



For More Information:

Additional information
may be obtained from the
following sources:

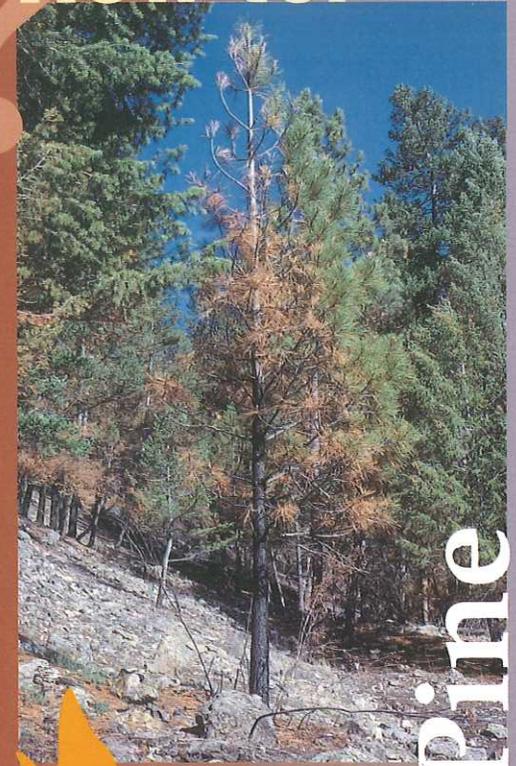
County Extension Offices
State Forestry Agencies
USDA Forest Service,
Forest Health Protection



R1-04-13

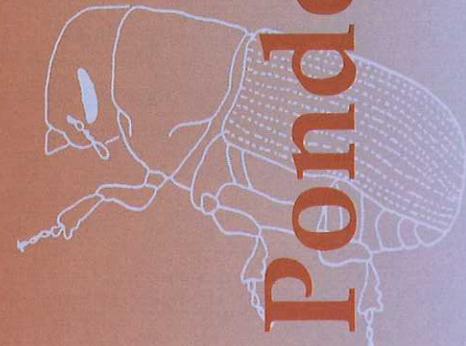
The USDA is an equal opportunity
provider and employer.

How to:



- Identify Ponderosa pine which will survive fire damage
- Determine amount of fire injury which will kill a Ponderosa pine
- Protect fire-weakened Ponderosa pine from bark beetle attack

Ponderosa pine



Ponderosa Pine

Crown Scorch:

Ponderosa pines may survive up to 75% crown scorch if fire occurs later in the summer, after buds have set for the following year. Long needles provide protection for developing buds.

Bole Char:

Ponderosa pine bark is less readily damaged by fire; but damage depends on size and vigor of tree. If inner bark is destroyed on more than 50% of bole circumference, survival is unlikely.

Root Damage:

Damage to roots or root collar, to the extent that inner bark (cambium) is destroyed on more than half of tree's circumference or half of major lateral roots, will usually result in tree's death.



Assessing Damage

Crown: Look for brown, dried, or burned foliage. Estimate amount of foliage burned; be sure to look at all sides of tree. If more than 75% of foliage is dead, the tree likely will not survive.

Bole: Remove a small section of bark (about 1-inch square), near the tree's base, down to the sapwood. Determine color and condition of inner bark. If it is pale green and moist, it is still alive and healthy. If it is brown and dry, it has been killed. Check at 4 sites around tree's circumference. If inner bark at more than 2 of those sites is dead, tree survival is questionable.



Roots/Root Collar: At or below duff layer, check condition of inner bark using the same method as used on bole. If inner bark on more than half of the samples (more than half of tree's circumference, or more than half of large lateral roots) is brown, tree survival is unlikely. Trees with this amount of damage are often attacked and killed by bark beetles.



Remedial Action: If more than 75% of crown is burned and three or more bole and/or root samples show dead inner bark, tree will likely die. Fire- or beetle-killed trees may become a hazard and should be considered for removal.

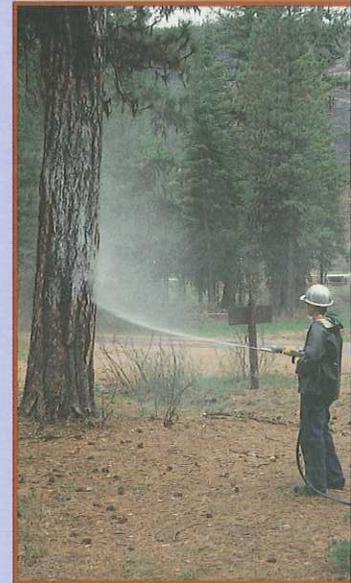
Protective Action: If half or more of tree's inner bark is healthy, it will probably survive fire effects. It may, however, be susceptible to bark beetle attacks—especially if early season weather following the fire is unusually warm and dry. Trees may be protected from beetle attacks by:

Applying a water-based insecticidal spray to tree's bole. Carbaryl insecticide is registered as a preventive treatment against mountain pine beetle, western pine beetle, and pine engraver beetles. It is a safe, economical, and efficient means of protecting susceptible trees from beetle attacks. Application information may be obtained from most county, state, or federal forestry agencies.

Note:

1. Preventive treatments must be done in early spring, usually by mid-April, and must be done **before** tree is infested. A beetle-infested tree cannot be saved. Treatments may need to be repeated for 1-2 years.

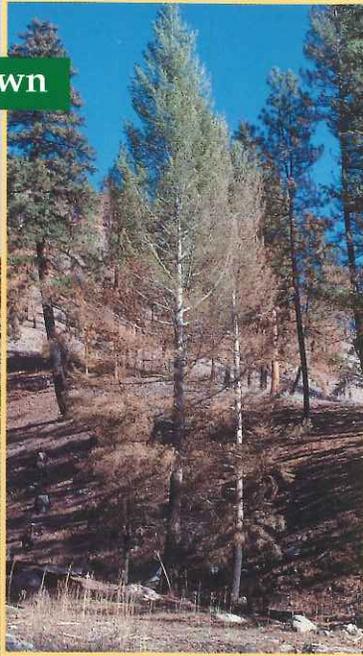
2. Trees which have been attacked by bark beetles (look for reddish-brown boring dust on tree's lower bole) should be removed to prevent emerging beetles from attacking nearby healthy trees.



What to Do?

Douglas Fir Survivability Is Determined By Amount Of Damage To:

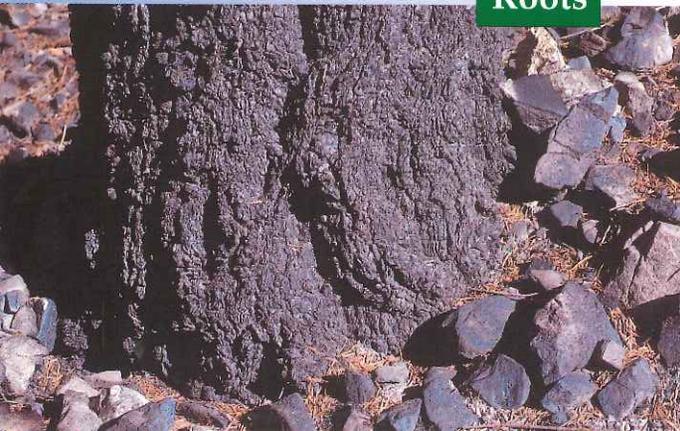
Crown



Bole (Trunk)



Roots



For More Information:

Additional information
may be obtained from the
following sources:

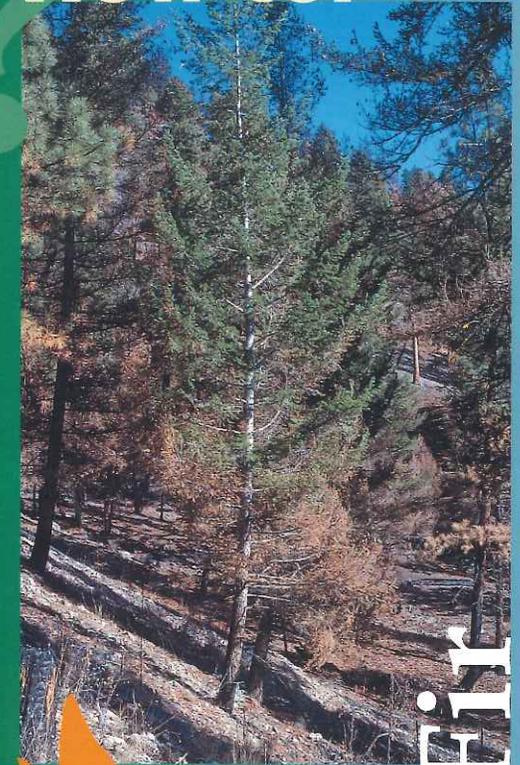
County Extension Offices
State Forestry Agencies
USDA Forest Service,
Forest Health Protection



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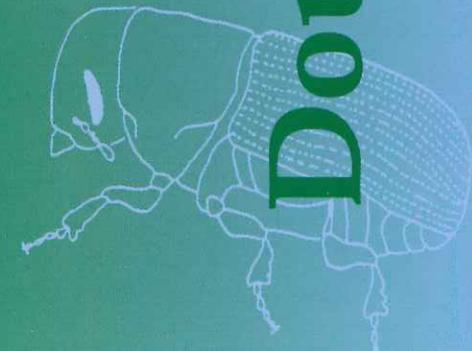
The USDA is an equal opportunity
provider and employer.

How to:



- Identify Douglas-fir which will survive fire damage
- Determine amount of fire injury which will kill a Douglas-fir
- Protect fire-weakened Douglas-fir from bark beetle attack

Douglas Fir



Crown Scorch:

Douglas-fir with more than 50% crown scorch, particularly if developing buds have been destroyed, are less likely to survive.

Bole Char:

Douglas-fir bark, on mature trees, is less readily damaged by fire; but damage depends on size and vigor of tree. If inner bark is destroyed on more than 50% of bole circumference, survival is unlikely.

Root Damage:

Damage to roots or root collar, to the extent that inner bark (cambium) is destroyed on more than half of tree's circumference or half of major lateral roots, will usually result in tree's death.



Assessing Damage

Crown: Look for brown, dried, or burned foliage. Estimate amount of foliage burned; be sure to look at all sides of tree. If more than 50% of foliage is dead, the tree likely will not survive.

Bole: Remove a small section of bark (about 1-inch square), near the tree's base, down to the sapwood. Determine color and condition of inner bark. If it is pale green and moist, it is still alive and healthy. If it is brown and dry, it has been killed. Check at four sites around tree's circumference. If inner bark at more than two of those sites is dead, tree survival is questionable.

Roots/Root Collar: At or below duff layer, check condition of inner bark using the same method as used on bole. If inner bark on more than half of the samples (more than half of tree's circumference, or more than half of large lateral roots) is brown, tree survival is unlikely. Trees with this amount of damage are often attacked and killed by bark beetles.

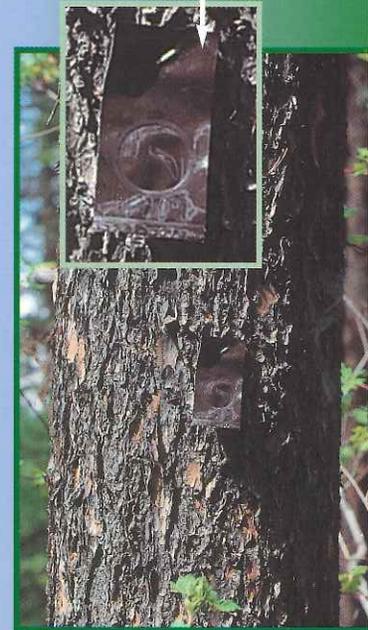
Remedial Action: If more than 50% of crown is burned and three or more bole and/or root samples show dead inner bark, tree will likely die. Because dead Douglas-fir deteriorate rapidly, fire- or beetle-killed trees may become a hazard and should be considered for removal.

Protective Action: If half or more of tree's inner bark is healthy, it will probably survive fire effects. It may, however, be susceptible to Douglas-fir beetle attacks—especially if early season weather following the fire is unusually warm and dry. Trees may be protected from beetle attacks by:

1. Attaching bubble capsules containing an anti-aggregating pheromone of the beetle to susceptible trees. Bubble capsules, hand-stapled to trees, are relatively inexpensive and are available through state or federal forestry agencies.
2. Applying a water-based insecticidal spray to tree's bole.

Note:

1. Preventive treatments must be done in early spring, usually by mid-April, and must be done **before** tree is infested. A beetle-infested tree cannot be saved. Treatments may need to be repeated for 1-2 years.
2. Trees which have been attacked by Douglas-fir beetles (look for reddish-brown boring dust on tree's lower bole) should be removed to prevent emerging beetles from attacking nearby healthy trees.



Fire Injured Trees: Making an Initial Assessment of Whether a Tree is Likely to Die
Karen Ripley, Forest Health Program Manager
September 2012

Although it can be difficult to discern when a conifer tree actually dies and many systems exist for assessing whether fire injured conifer trees are likely to die, making an *initial* assessment of tree injuries can be very simple. These steps are intended to give affected landowners a place to start. They aren't the whole story.

1. Were any of the needles consumed or "set" in one direction by the fire?

If so, the tree likely received a lethal injury and is dead or will die.



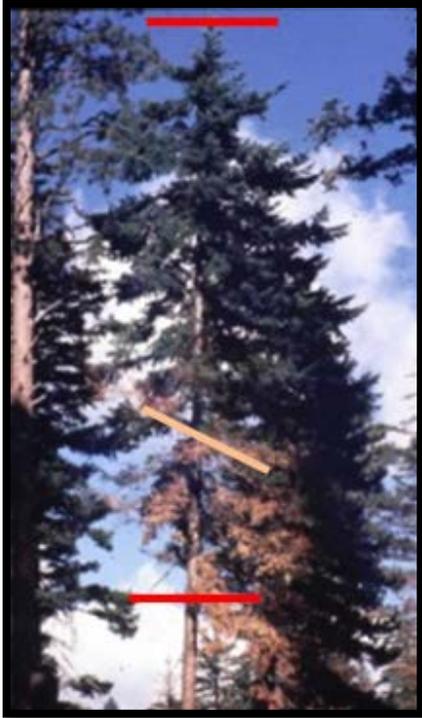
Ponderosa pine with 100% of its live crown scorched and some of the needles consumed. This tree is unlikely to survive its injuries.



Ponderosa pine sapling with needles "set" in the direction the heat and fire moved past it. This tree is unlikely to survive its injuries.

2. How much of the crown volume was scorched?

Calculate a percentage of the crown that was alive prior to the fire and is now scorched. An undamaged tree has 0% crown scorch. A tree with its entire crown changed to a reddish color has 100% crown scorch. Here are some samples of calculating crown scorch volume. Record each tree's species and DBH when observing the crown scorch.



Just about everything above the beige line is fine, so about 75% fine and 25% crown scorch.

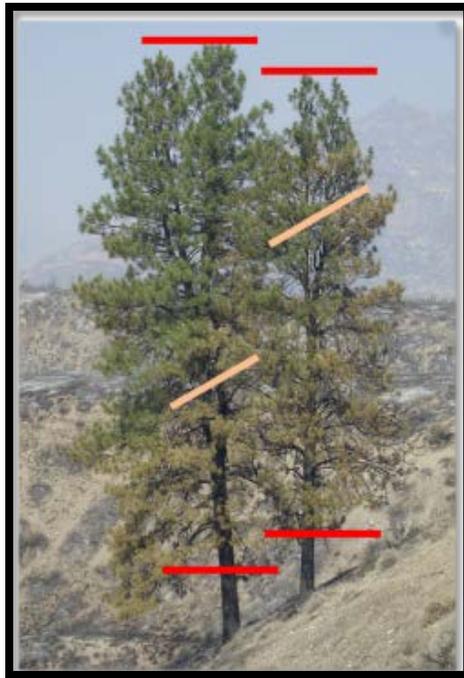
First, if that low branch (in the green oval) is mentally moved up above the lower red line, then about 50% of the tree canopy is below the beige line and 50% is above the beige line.



Second, the top half of the crown is pretty much ok. So the tree is at least 50% fine.

Third, of the bottom 50%, about 35% is scorched and 15% is ok. So the tree crown is about 65% fine and 35% scorched.

Tree on the left:
Just about
everything above
the beige line is
fine, so about
60%-70% fine
and 30%-40%
crown scorch.



Tree on the right:
Just about
everything above
the beige line is
ok, so about 25%
fine and 75%
crown scorch.

3. Interpreting what the crown scorch levels mean for tree mortality.

- Large diameter trees have thicker bark and can endure more crown scorch than smaller diameter trees.
- Ponderosa pine (with large buds and very thick bark when it's mature) can endure more crown scorch than other conifer trees of similar size that have smaller buds and thinner bark.
- Use a more detailed reference such as http://www.google.com/url?sa=t&rct=j&q=after%20the%20burn%20idaho&source=web&cd=1&ved=0CCIQFjAA&url=http%3A%2F%2Fextension.oregonstate.edu%2Fsites%2Fdefault%2Ffiles%2Fcommunity_pgs%2Fwild_fire_after_the_burn_2011.pdf&ei=pXNbUOrPOqKRiAKU1YG4CQ&usg=AFQjCNEFJfKSucuTVsn-OZ7GIBTIT8NDvQ (tables that chart the probability of mortality by tree species, size and crown scorch start on page 51) to interpret the likelihood a given tree species, size and scorch amount will die.
- In general, trees with less than 50% crown scorch are more likely to survive. Trees with greater than 75% crown scorch are more likely to die.
- Note, this is a VERY rough assessment system and does not take into full consideration the amount of injury that the stem or roots received. Even

a tree with little crown scorch can die if there was a lot of duff or nearby wood debris that burned causing significant root damage or stem char.

- If they were in good health prior to the fire and have good growing conditions during the first few years after the fire, trees are more likely to survive more severe injuries.
- Sometimes landowners want to be more conservative, and wait/monitor even the iffy trees. This is appropriate especially if the land was heavily damaged and there aren't many trees left or if he/she can be attentive to the stand, watching it over time, and removing dying trees as the symptoms manifest themselves. If a landowner really just wants to get all the work done in one operation or the stand was heavily overstocked to start with, he/she might choose to simply remove more of the borderline-survivor trees in a single entry.
- Every forest management activity, including salvage, is an opportunity to improve forest health, address deficiencies that contributed to the damage, and make progress toward your long term goals.
- Give as much thought to the condition you are leaving the forest as to what you are taking away.
- Mimic the effects that idealized natural fire would have had such as increasing the proportion of pine and larch; reducing the proportion of Douglas-fir and other fir; removing the smallest, weakest trees; reducing the impact of dwarf mistletoe and other diseases.



Tree Survival After a Fire

The level of scorch determines whether a tree will survive a fire. Ponderosa pine and Douglas-fir are adapted to fire, but this resistance increases with age. Generally, younger trees are more susceptible to damage.

Some mechanisms of fire resistance are:

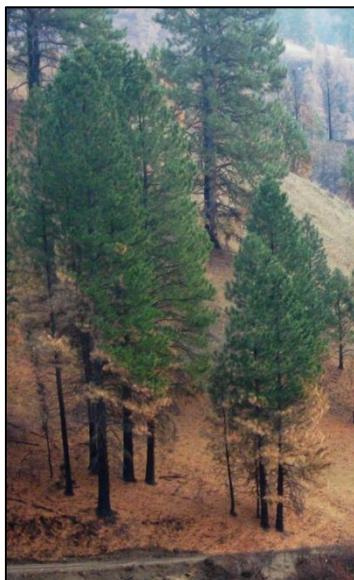
- **Thick bark** Western larch, Douglas-fir and ponderosa pine develop thick bark at the base which will tolerate some scorch. This thick bark is not present in young trees.
- **Protected buds** Ponderosa pine buds are protected from heat by long needles.
- **Self pruning branches** Shade intolerant species (pines and larch) that are grown in denser stands usually have fewer green branches close to the ground. When grown in the open, pines and larch may have green lower branches that are easily damaged by fire.

Crown , Bark, and Root Scorch

See US Forest Service pamphlets on Douglas-fir and ponderosa pine survivability after a fire.

- **Crown scorch** If the dormant buds have developed for the next season, trees are more likely to survive crown scorch. Early season fires, before buds have hardened off, are more damaging. Look for green buds and shoots, even if the foliage is scorched. Ponderosa pine can survive up to 75% crown scorch, Douglas-fir can tolerate up to 50% scorch.
- **Bark scorch** The inner bark (phloem) is the sugar conducting tissue in trees, and is vulnerable to excessive heat. If the fire was fast moving or was a light ground fire, the bark may provide enough protection for the phloem. Look for moist, green or cream colored inner bark. If the inner bark is dried and brown, it has been killed by heat. Trees of any species are not likely to survive if more than 50% of the circumference is damaged.
- **Root damage** If trees have a thick duff layer around the base, they are vulnerable to root damage, even if the fire did not burn particularly hot. Check the condition of the bark on major structural roots and the root collar area. If 3 or more of the samples show brown phloem, the tree will probably not survive.

Trees likely to survive

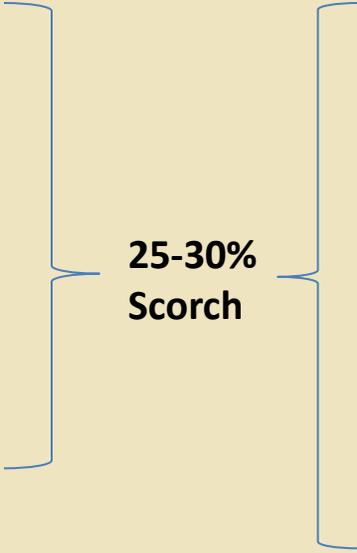


Trees likely to die



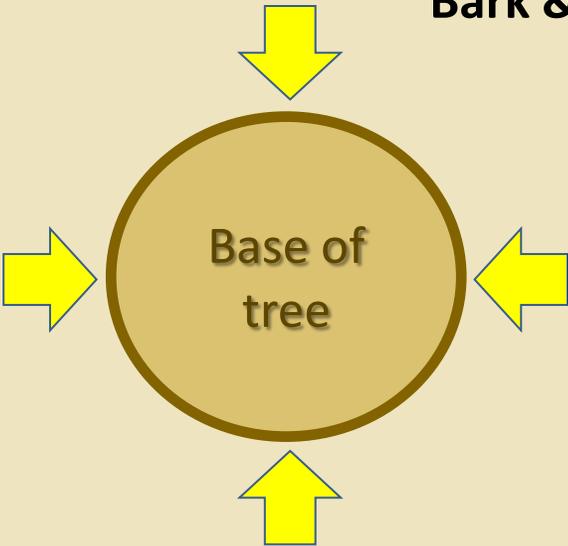
Trees that survive the fire may still be attacked by bark beetles or borers later

Tree Survival After Fire

| Firs | Crown Scorch | Pines |
|---|---|---|
|  |  |  |
| Firs with <50% crown scorch should survive fire | 25-30% Scorch | Pines with <75% crown scorch should survive fire |
| <i>See below, condition of inner bark also determines survivability</i> | | |

| Firs | Bud Condition | Pines |
|---|---|--|
|  |  |  |
|  | | |
| Moist, green buds are still alive | Douglas-fir buds killed by heat | Pine buds are often protected by foliage |
| | | Ponderosa pine bud killed by heat |

Bark & Root Condition



Base of tree

Live Bark



Phloem (inner bark) is still moist and cream colored

Dead Bark



Phloem (inner bark) and adjacent sapwood is dry and brown

Check condition of inner bark and/or main roots at 4 locations around tree

If inner bark is brown and dead at 2 of 4 locations, the tree will probably die from effects of fire

Trees that survive the fire may still be attacked by bark beetles or borers later