TCIA Pocket Guide

Identifying Hazard Trees

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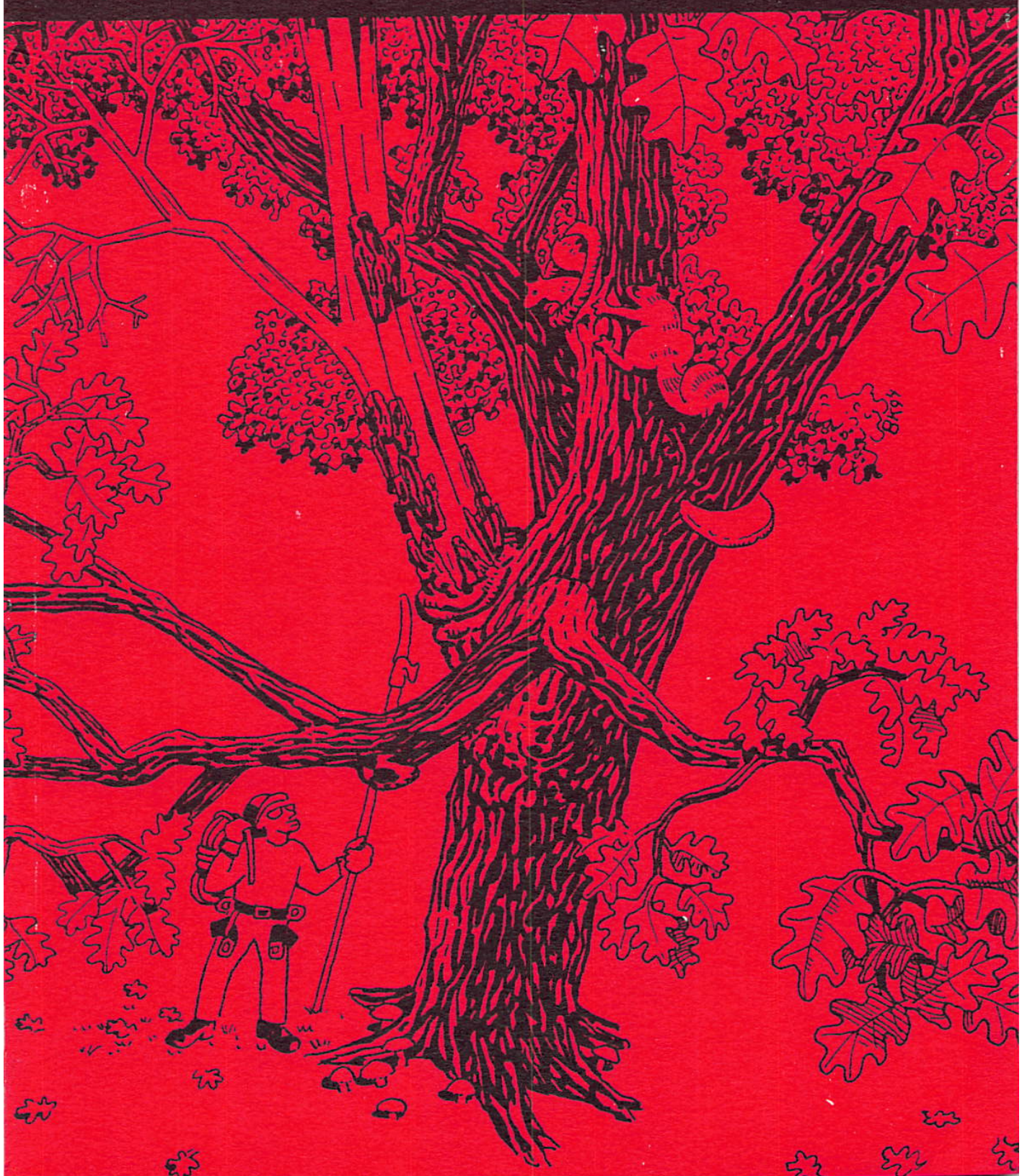

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Identifying Hazard Trees

The Tree Care Industry Association, Inc.

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Indentifying Hazard Trees

Originally published as *The Climber's Guide to Hazard Trees* by the Bartlett Tree Research Laboratories. Reproduced and distributed by the Tree Care Industry Association by permission of the F.A. Bartlett Tree Expert Company, Dr. Thomas Smiley and Joseph C. Bones, authors. Revised in 2000, and later in 2008 by TCIA Staff.

A letter from the TCIA:

Dear Reader:

Worker Safety is a goal shared by everyone professionally involved in tree care. Efforts such as this show the cooperative spirit that exists in commercial arboriculture.

We are grateful to the individuals within the Bartlett organization who created this booklet and to Mr. Robert A. Bartlett, Jr. for giving TCIA permission to include this publication as part of TCIA's offerings for training field personnel.

Please use this Pocket Guide with the four companion Guides and TCIA's other training materials to familiarize yourself with hazards found at the tree care work site. **Climb Safely!**

Sincerely,
The Tree Care Industry Association, Inc.

Purpose of Publication

This booklet was developed to provide tree climbers with information on the common hazards associated with their profession. It should be used by climbers, crew leaders and arborists to assist in the identification of hazardous conditions and in the process of deciding if a tree is too hazardous to climb.

Credits

We would like to thank the following people who contributed to this publication: Dr. Bruce Fraedrich, Craig Clark, Lynn Roberts, Pat Flynn, Dave deSousa, Walt Dages, Dave Anderson and all the Bartlett dendricians who took the time to provide their insight on hazardous trees.

Illustrations are from: J. Albers and E. Hayes. 1993. *How to Detect, Assess and Correct Hazard Trees in Recreational Areas,* Minnesota Department of Natural Resources; A. Shigo and H. Marx. 1977. *Compartmentalization of Decay in*

Trees, U.S. Forest Service; A. Shigo. 1979. *Tree Decay - An Expanded Concept*, U.S. Forest Service; and Bryan Kotwica.

Introduction

Tree hazards take many forms. They may be obvious tree hazards, such as extensive decay, or they may be electrical wires tangled in the brush of a fallen tree. It is the responsibility of every employee to locate, identify, and evaluate all potential hazards for each tree where work is planned.

This manual is intended to be used as an on-the-job reference by all new and veteran climbers, in safety programs, and in weekly tailgate talks.

Performing the work safely must always be your first concern.

Communication

Judging the safety of a tree is an essential procedure that must be done on every tree to be climbed. The decision-making process requires experience and knowledge. If you are in doubt concerning a tree's condition, ask for advice from your coworkers.

Talk with your crew leader, supervisor or other experienced tree workers to review the tree's structural strength.

Sales representatives, arborists, or supervisors should discuss questionable trees with the crew leader before scheduling the work.

Examination of the job site before the work is scheduled allows for proper planning and equipment selection. This enables the work to be performed safely and avoids costly crew delays.

Specialized Equipment

Once a tree is determined to be unsafe to climb, the following alternatives may be used to safely perform the work.

- An aerial lift may allow the tree to be removed without climbing.

- Using a crane to remove large limbs may reduce the hazard to an acceptable level.

- Tie into and work from an adjacent sound tree. Get permission from the tree's owner.

- Targets such as fences or small plants may be moved, allowing the tree to be felled from the ground without climbing.

- Other specialized equipment may be used depending on the size and type of hazard.

If the hazard is electrical wires, those who are not line-clearance tree trimmers should have the utility company de-energize lines or provide clearance.

Tree Examination For Climbers

Fig. 1. Inspect before you climb!

Inspect each tree completely from the ground **before you climb** or begin work. Inspect the surrounding area for electric wires and other potential hazards.

Walk around the tree to examine all parts of the tree from the roots to the branches. **As you climb,** continue to look for problems that were not visible from the ground. Be aware of the movement

or sway of the tree. If the tree does not move as it should, there may be a hidden problem.

If soil or vines cover portions of the trunk, they should be removed or opened up for examination of the trunk and root collar. Vines and soil often hide hazardous situations.

Roots

All trees need a substantial root system to keep them standing. However, only a small portion of the root system is visible above the soil surface.

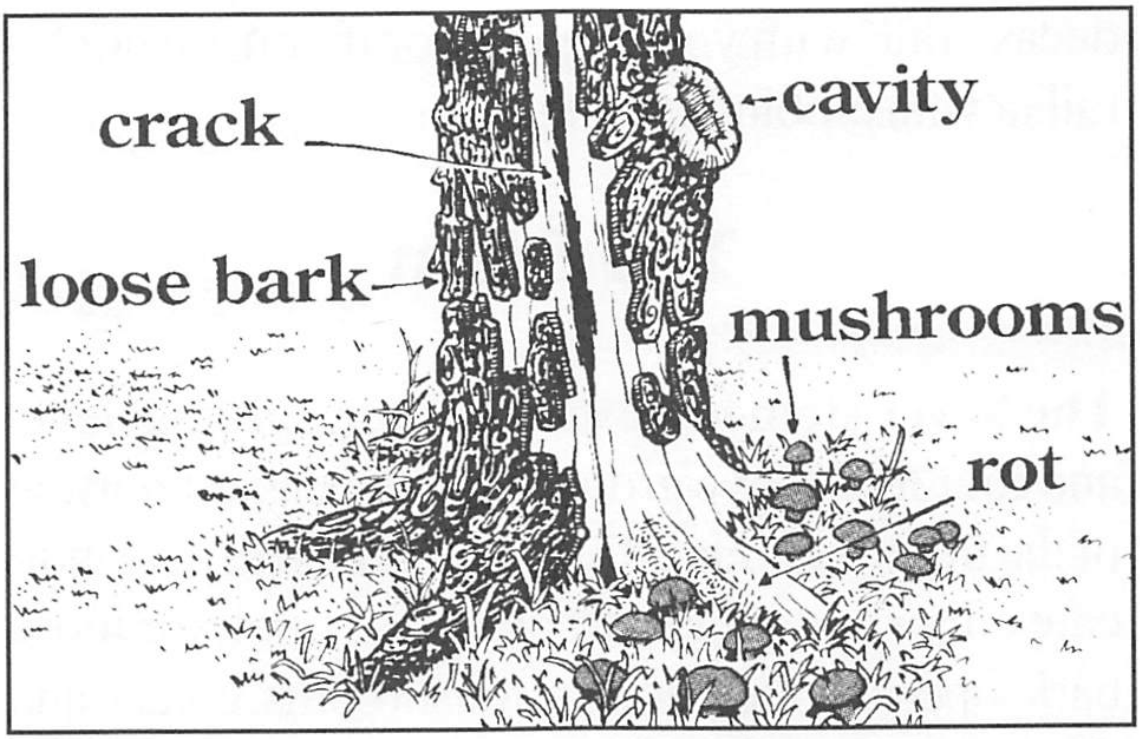


Fig. 2. Some trunk and root hazards are cracks, cavities,wood decays, cut roots, etc.

Trees should have a flare at the base. If this is not present, soil or mulch may be hiding symptoms of decay in the stem or roots.

Many symptoms on or above the buttress or flare roots can give an indication of the condition of the rest of the root system. Any root decay visible near the trunk could indicate extensive root loss, because decay begins in outer sections of roots and works back toward the trunk.

Fungus structures, including mushrooms and conks, indicate decay. Only probing with a drill or other device will determine the presence and extent of decay. Talk with your supervisor if you are not familiar with probing techniques.

The Stem

The lower stem is the area between ground level and four feet above ground. It is the easiest portion of the tree to examine. Defects found here may indicate either a root or stem problem. Look for loose bark, open cavities, cracks, mushrooms, conks, and depressions or swellings in the stem. These can indicate a serious trunk or root decay.

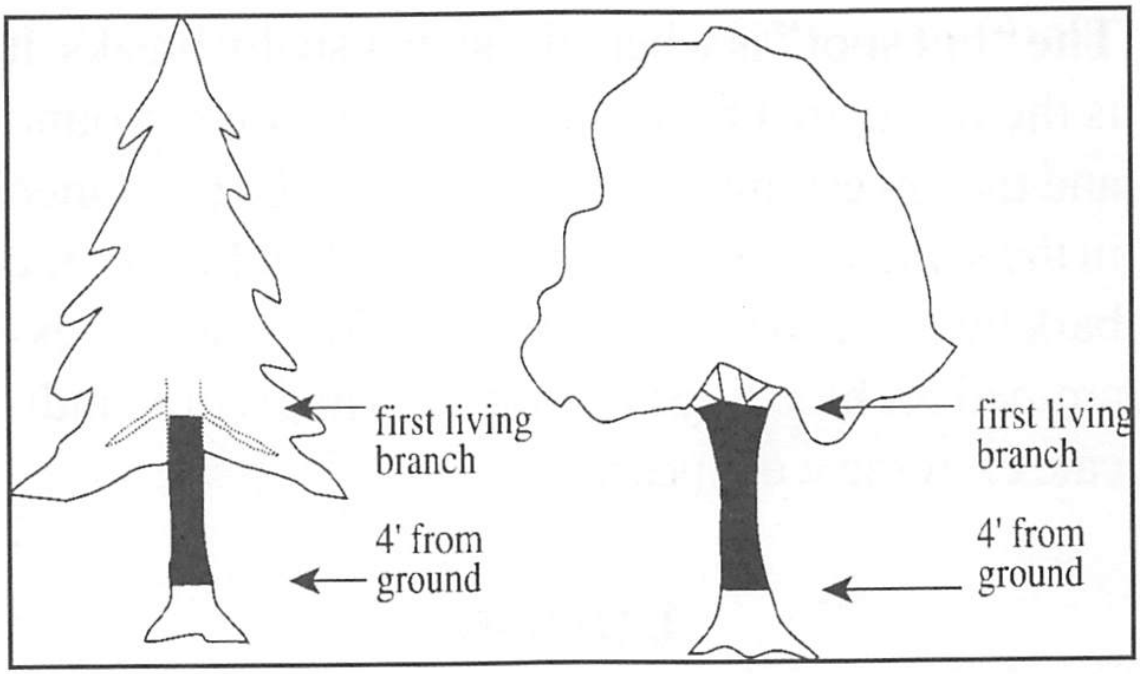


Fig. 3. Shaded areas are "hot spots" for structural weakness in conifers and hardwood trees.

If decay is present, the extent of weak wood should be determined before the tree is climbed. Examination can be done by probing with a knife, stiff wire or a drill. See the section on Hollows and Decay (page 18) for details on acceptable limits of decay.

If you are unsure whether or not the wood thickness is great enough to allow climbing or lowering, a more detailed analysis of the tree may be necessary. This must be performed by an arborist who has completed specialized hazard tree evaluation training.

The "hot spot" is where the stem usually breaks. It is the trunk area between four feet above ground and the lowest limb. This area should be examined in the same way as the lower trunk. In addition, the bark beneath any V-crotches should be closely examined for bleeding and cracks, which could indicate extreme weakness.

Limbs

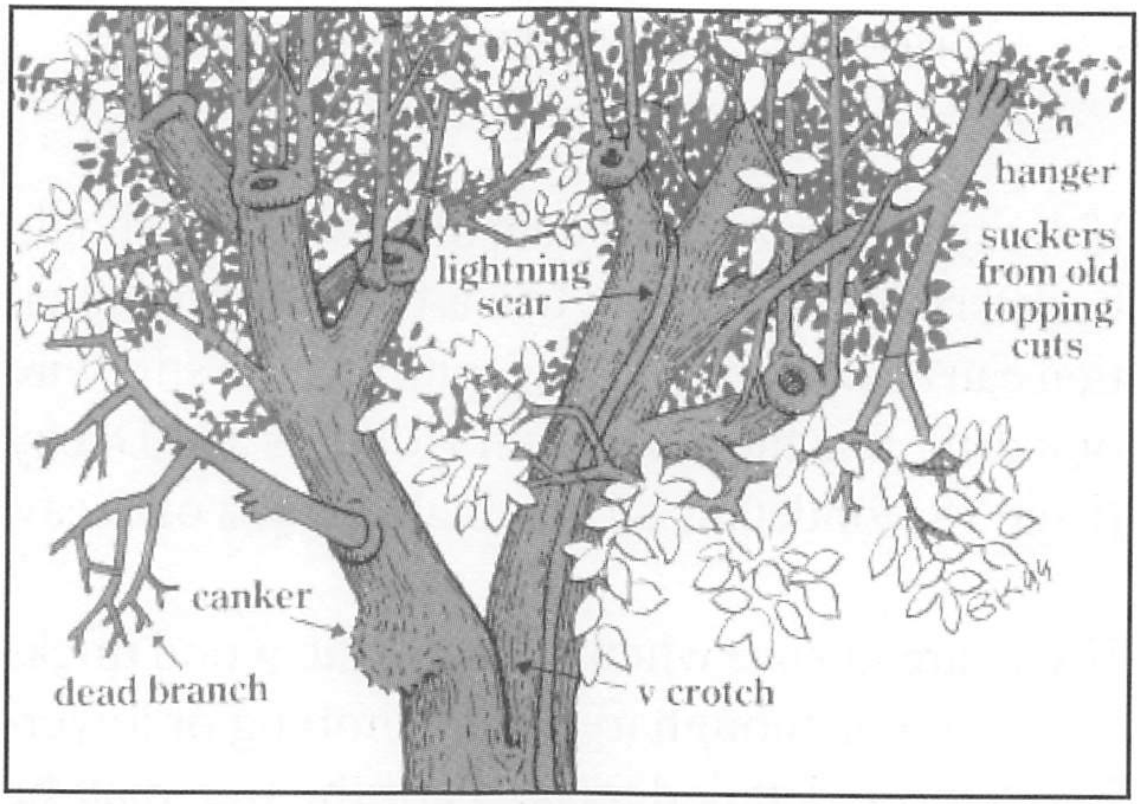


Fig. 4. Tree limb hazards include watersprouts, hangers, cankers, dead branches, lightning damage, and weak crotches.

Inspect limbs for loose bark, cracks, fungal fruiting structures and decay. Limb scars indicate a history of limb failure and the potential for more failures. Plan your ascent to avoid weak limbs.

Thoroughly examine any limb before tying into it, walking on it, or lowering from it.

Limbs that arise from topping cuts are often poorly attached due to the angle of growth and internal decay. They are not good choices for setting either climbing or lowering lines.

DEFECTS

Look for the following defects.

Peeling Bark

Bark begins to come off of limbs, trunks and roots of hardwoods typically within three to six months of when the tree or part of the tree dies. Some species such as hemlock tend to retain their bark for longer periods. When bark cracking or peeling is observed, inspect the wood beneath to make sure it is sound. When climbing a tree with loose bark, it is best to use a climbing line rather than tree climbing spikes.

Cracked or loose bark at the base of the stem may indicate severe root rot. The stability of the tree and extent of root decay should be judged prior to climbing the tree. Stability can be judged by throwing the line into the tree and carefully pulling in several directions. Pull hard enough to assess the movement of the tree but not hard enough to break any section of the tree.

Sapwood Decay

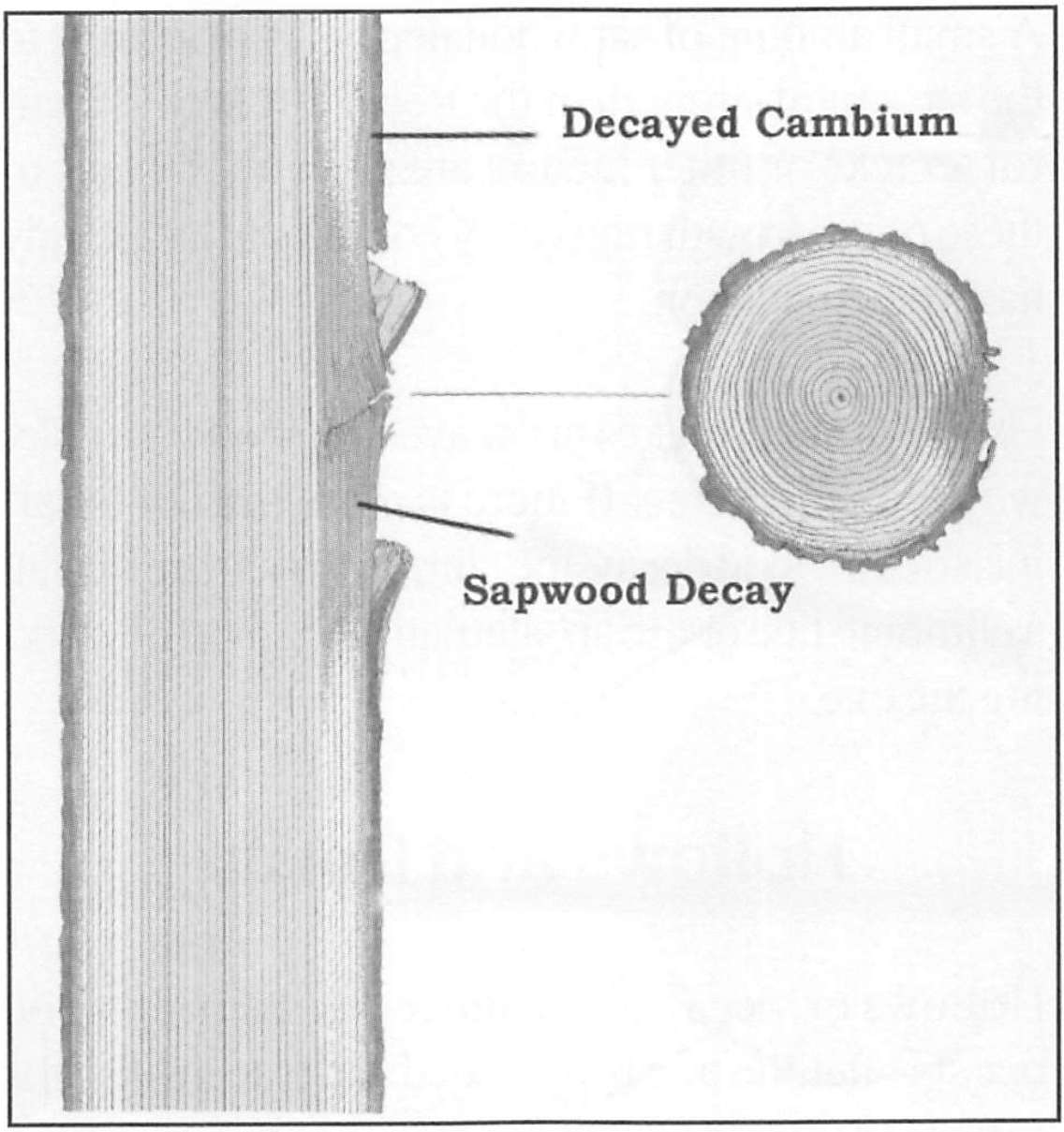


Fig. 5. Sapwood decay after a surface injury. Note vertical spread of decay beyond injury site (left).

Sapwood decay or decay of the outer wood may occur prior to the death of a tree. After a tree dies, the problem tends to be greater. Trees that keep

their bark after death tend to have more sapwood decay since the bark holds in moisture.

A small amount of sapwood decay is not a threat to the structural strength of the tree. However, if heart rot, cracks or other factors are present, the loss of these outer growth rings may compound an already hazardous situation.

Using climbing spikes in decayed sapwood is a risky way to climb a tree. If there is more than one-half inch of sapwood decay, the climber should tie in with a climbing line or use an alternative method of working the tree.

Hollows and Decay

Hollows or decay of the inner cylinders of wood occurs after the tree is wounded and a decay fungus infects the wood. Years are required before a fungus significantly weakens a tree. This type of decay occurs in stems, roots and limbs.

Hollows and internal decay can be detected by examining the trunk for open cavities, fungus structures

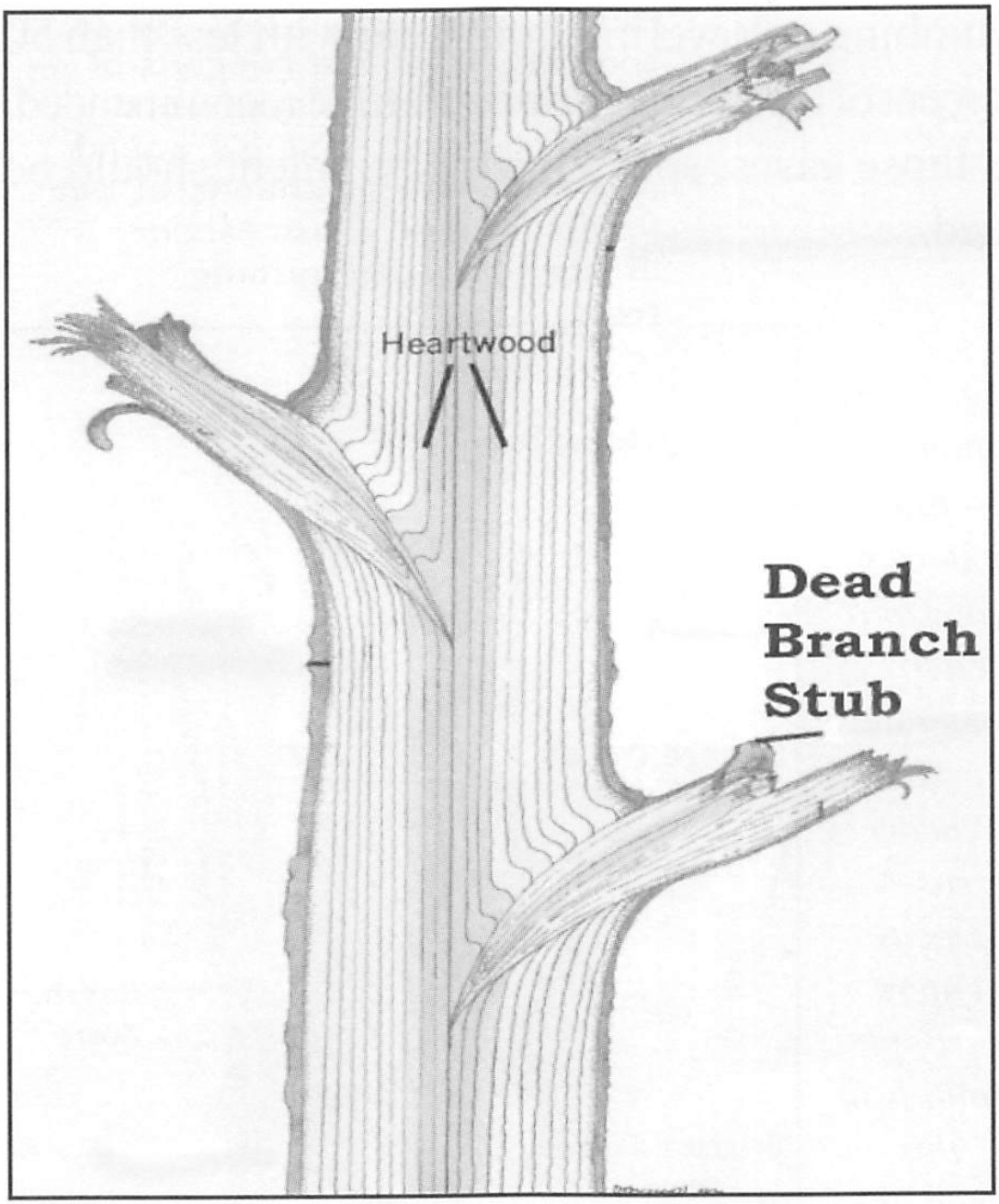


Fig. 6. Decay enters through dead stubs in this example. Decay is not visible from outside.

or cracks, or by "sounding" the trunk or limb with a rubber mallet. To determine the extent of decay, the stem must be drilled or cored with an increment borer, or tested with more sophisticated equipment.

Climbing or lowering from trees with less than 50 percent of their original strength is not recommended. In those cases, specialized equipment should be used.

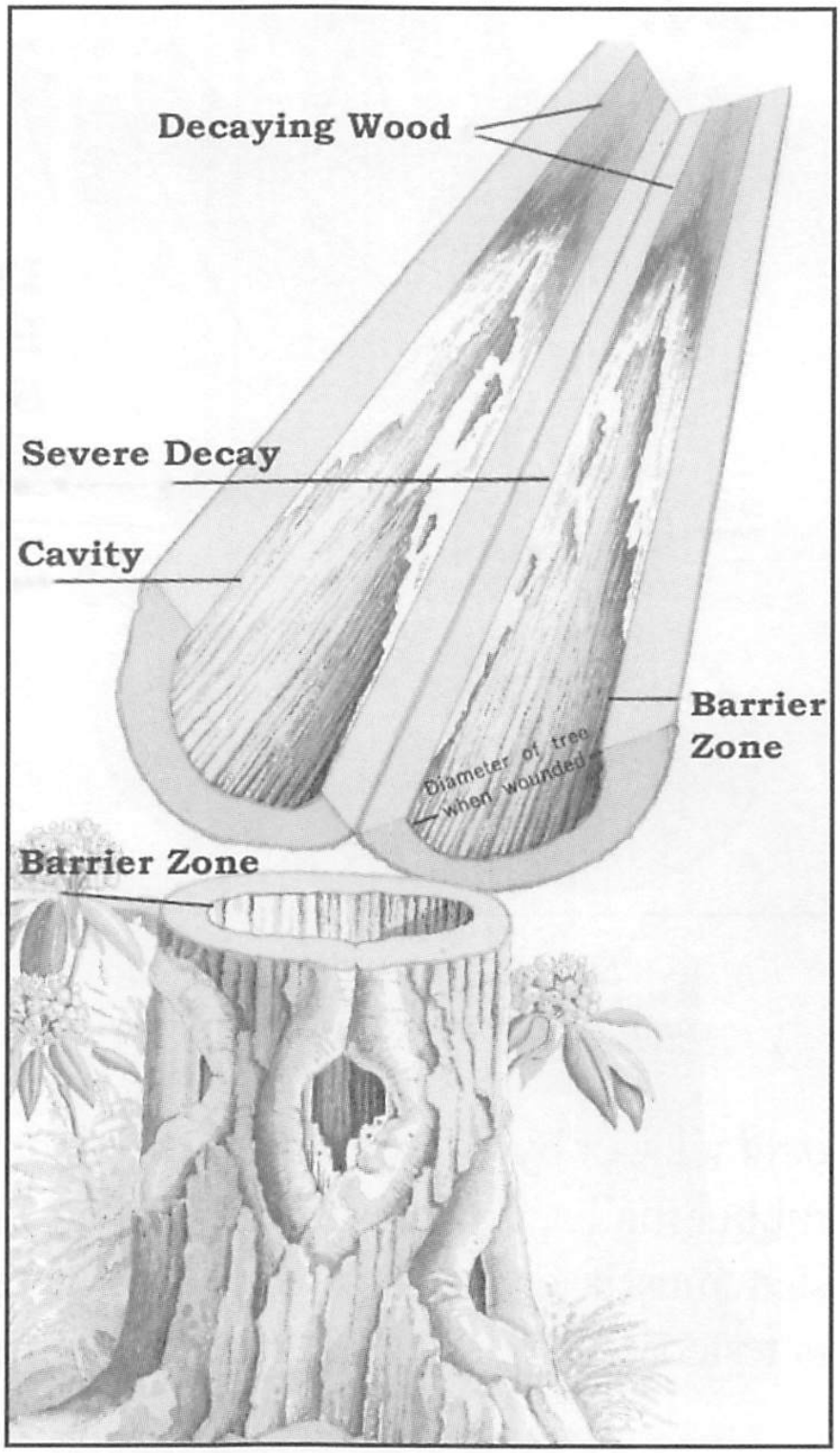


Fig. 7. An internal and external view of a cavity, sometimes called "heart rot." Decay enters through wounds in this example.

The table below shows the minimum wood thickness that constitutes a 50 percent strength loss. When using this table, remember to subtract the bark thickness from both the diameter measurement (D-tape value minus two times the bark thickness). Strength loss will be greater (trunk weaker) if there are cracks, cavity openings or other weakening factors. In those cases, the thickness of sound wood for a given trunk diameter will need to be greater than the values listed for it to be climbable.

Diameter of Stem/limb*	Thickness of sound wood*
10"	1"
20"	2"
30"	3"
40"	4"
50"	5"

* Not including bark

Ask a supervisor about wood strength lost to decay if you are not sure of potential strength loss.

Precautions also need to be taken before cutting trunks or limbs with decay. They often release or fall before expected.

Hollows and decay are most easily recognized when there is an open cavity. Other symptoms include cracks, cankers, conks and burls.

Dead Branch Decay

Depending on the species of tree, dead limbs start decaying within six months to two years after the death of the tree. The decay usually begins in the sapwood and works into the center of the tree. Inner wood usually decays more slowly than sapwood.

Symptoms of dead branch decay include cracking, peeling bark and fungus structures. If limbs display these symptoms, the climber should never rely on them to completely support his or her weight or the weight of a limb hanging from a lowering line. If the limb must be accessed or tied off for lowering, the climber must support the majority of his or her weight with the climbing line, which is tied into solid wood.

Cracks

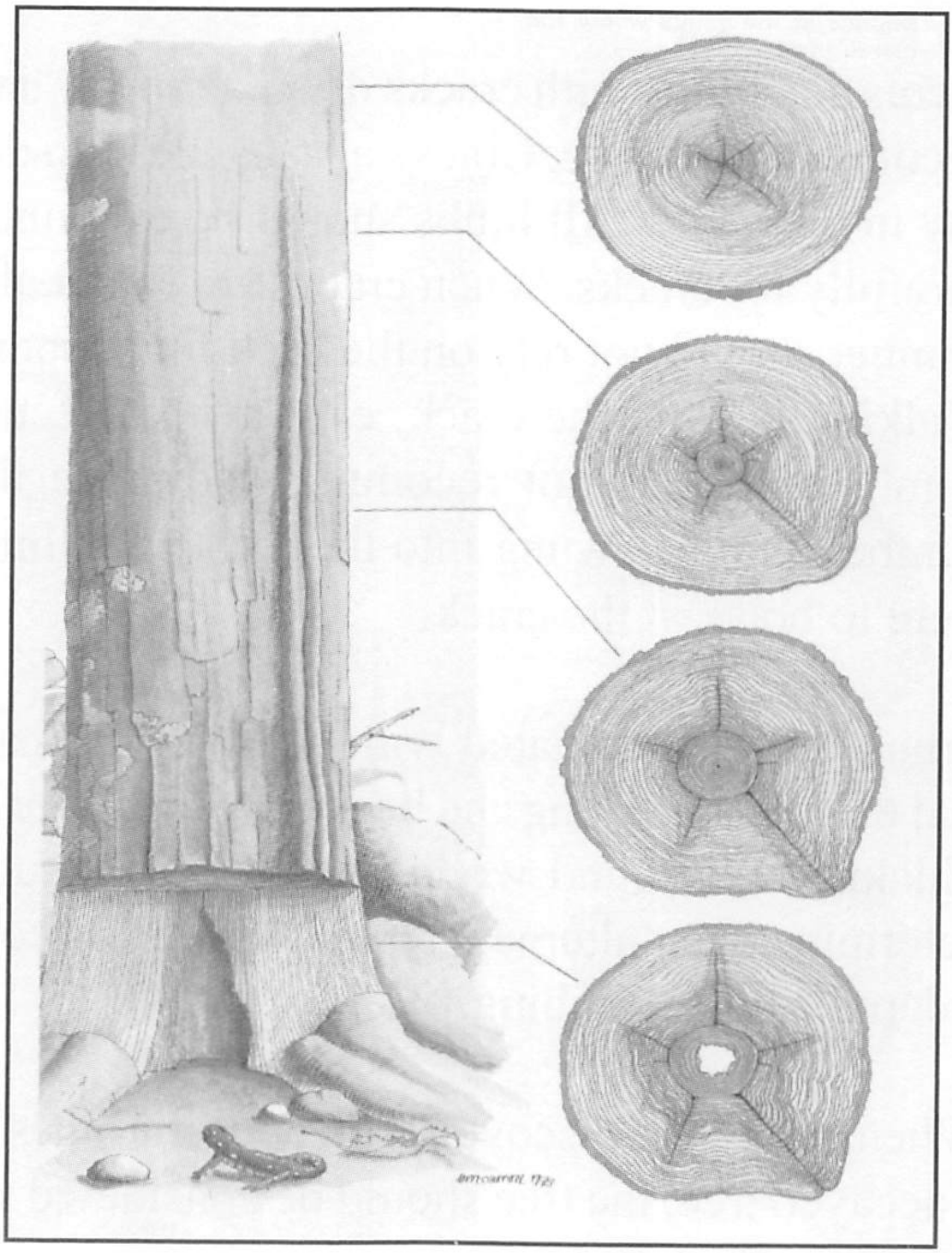


Fig. 8. A crack associated with decay.

Cracks occur on limbs, trunks and roots due to death of the inner bark (phloem) or sapwood. Cracks can also be formed when severe twisting or bending oc-

curs, such as during a storm. When cracks go deeply into the wood of trunks, heart rot usually is present.

Stems and limbs with cracks dry out rapidly and become more brittle. Cracks also can lead to decay in the wood. All limbs should be examined carefully for cracks. When cracks are found, the climber should not rely on the limb for support. Walking beyond the crack, even with a secure climbing line, is not recommended since the climber may be swung into the stub if the limb were to break at the crack.

Trunk cracks associated with heart rot indicate that the tree is twisting and beginning to fall apart. Thickness of sound wood should be carefully determined and alternate removal methods considered before climbing.

When cracks are discovered on opposite sides of a decayed tree, the tree should be considered seriously weakened.

Cracks, especially when associated with decay, may indicate a serious structural problem.

Woodpecker Damage

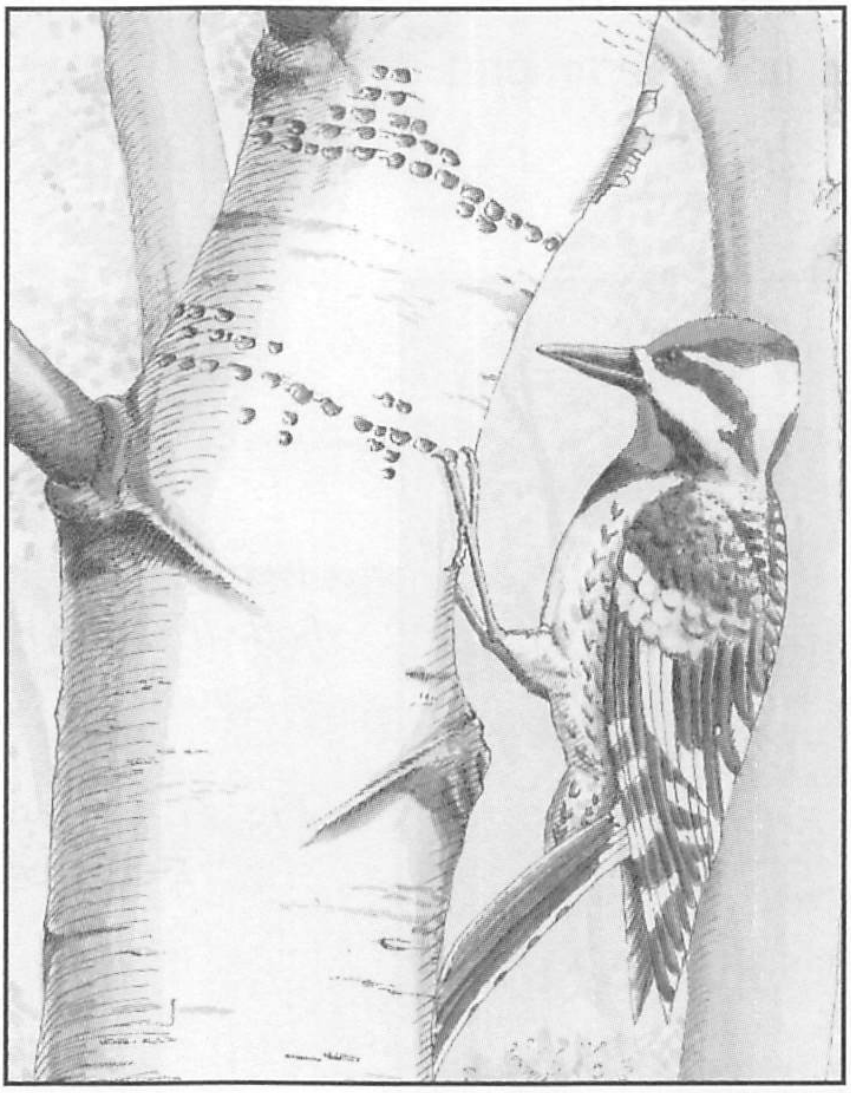


Fig. 9. Sapsucker/ Woodpecker feeding holes.

When nesting holes or woodpecker damage is observed, it is an indication that the limb or part of the trunk is dead or dying and decay has started. The extent of decay is impossible to estimate without probing.

On limbs with woodpecker damage, the climber should not rely on the limb to support his or her weight. Limb walking beyond woodpecker damage is not recommended.

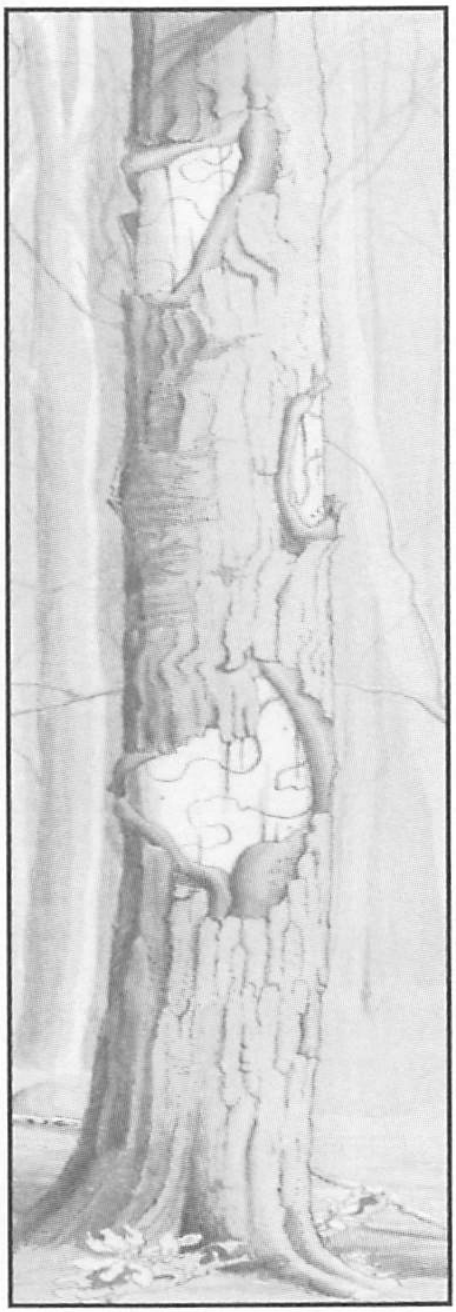
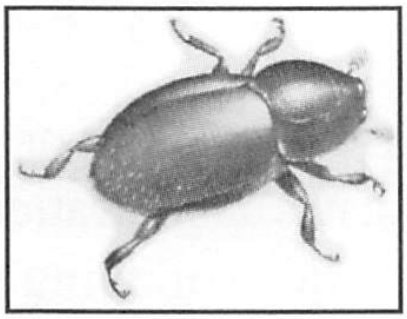


Fig.10. (left) Wounds from shade tree borer larvae (sugar maple borer shown).

Fig. 11. (below) Adult elm bark beetle.



Borers

Small (1/16-inch to 1/4-inch diameter) holes in the trunk or on limbs, sometimes associated with oozing sap or wet patches, indicate a borer infestation. These insects attack trees that have recently died or are in the final stages of decline. They may indicate that the bark will be weaker than on live trees, so caution should be taken when using climbing spikes. A thorough examination of the roots and remainder of the trunk should be made before ascending.

Cankers

Cankers are diseases of the bark caused by fungi or bacteria. Symptoms are generally a sunken, dead area on the bark. Cankers can cause a weakening of the outer layers of wood. Canker rots cause both a canker and wood decay. If decay is present and spreads into the wood, a very weak area is created because both the inner and outer growth rings are affected.

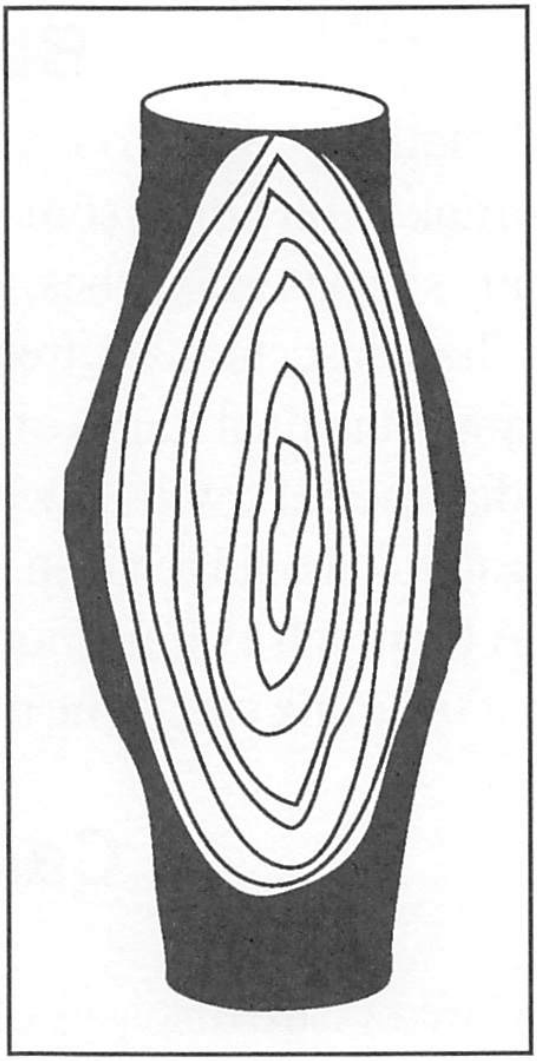


Fig. 12. A diagram of a "target" canker rot, such as that caused by Nectria spp.

Root Loss

When examining the buttress roots and root collar area of the trunk, check for loose or cracked bark, fungus structures such as mushrooms and conks, soft or hollow wood, mounded soil near the trunk and bleeding. All these are symptoms of serious root decay.

Root damage can occur during construction, including soil cuts or fills close to the tree, trenching, new paving or buildings, or other root cuts. Any mechani-

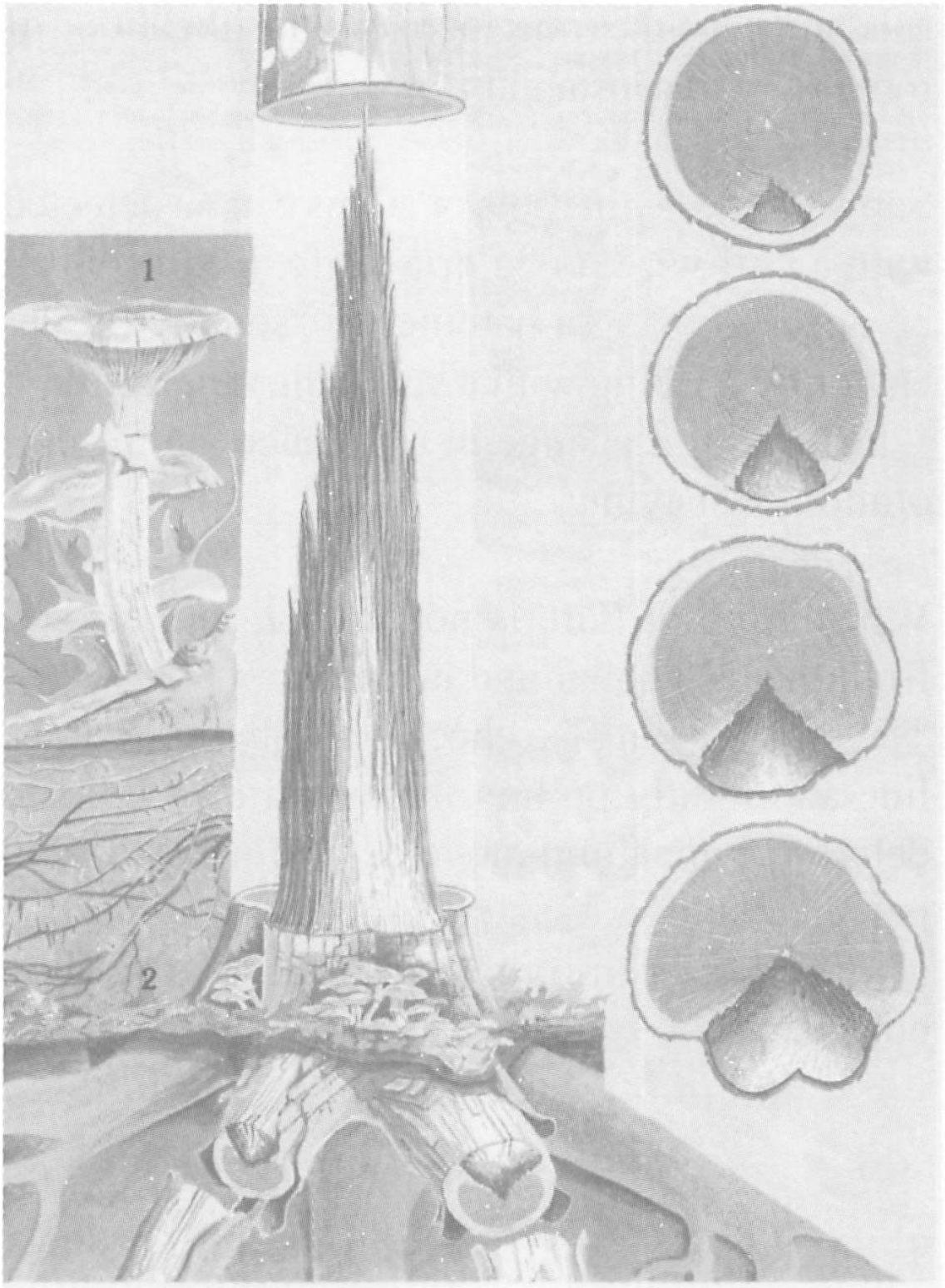


Fig. 13. Internal and external view of a tree with strength loss in the roots and lower trunk caused by decay. Shown: Armillaria mellea *(shoe-string rot) on oak: 1. mushrooms; 2. "shoe-string" fungal growth.*

cal damage to the roots increases the likelihood of root loss or tree instability.

Sapwood decay in roots or stems can be detected with a stiff wire probe or a knife. Heart rot can be checked using a hammer to "sound" for decay or by probing with a small diameter drill bit – feeling for a change in resistance and discoloration of shavings.

When the root flare is not visible, remove soil from the root collar and inspect roots for decay. The climber can also check stability by setting a line and lightly pulling in several directions to determine unnatural movement. If more than 50 percent of the root system is decayed or missing, alternative removal methods should be considered.

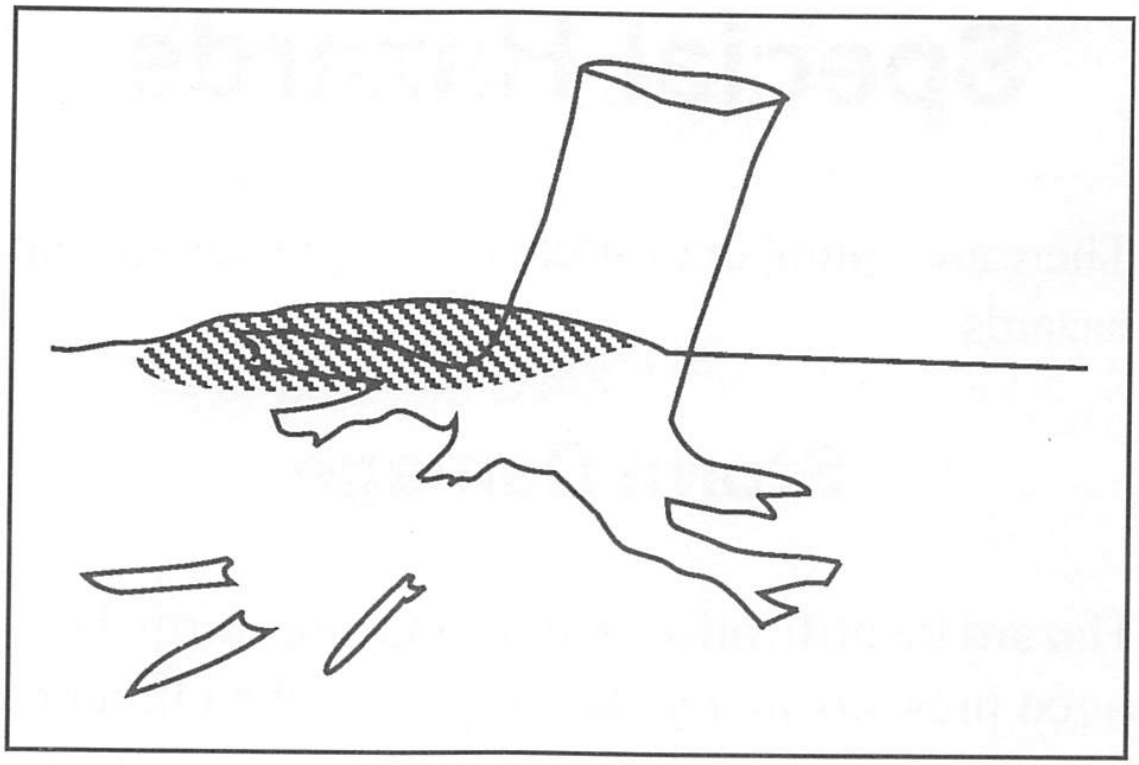


Fig. 14. Ground heaving due to a leaning tree. Tree lean caused by root loss in this example.

Ground Heaving

The lifting of soil adjacent to a tree may indicate that the tree has started to fall over. Trees in wet areas are prone to this type of failure. Construction damaged trees and those with root rot may also have this problem. Additional weight in these trees may make them fail.

Special Hazards

There are a number of situations that create special hazards.

Storm Damage

Hazard identification in trees that are storm damaged presents many challenges for the climber.

Extra care must be taken to evaluate any storm-damaged tree for possible "hidden" hazards before it is climbed. **Some things to look for before and during the climb include:**

- Wires hidden by leaves and branches. Trees may become energized when electric wires contact them, or other wires such as telephone lines that contact electric wires. Consider all wires as energized.

- Cracked stems and crotches.

- Broken limbs and tree tops that may be hanging or hung up over the climbing route.

- Broken limbs held by support cables.

- Points of pressure and tension on limbs or small trees underneath larger fallen trees.

- Ice, snow, wet conditions or excessive heat may all present potential hazards when working in storm emergencies.

Storm damage often requires long working hours in high stress situations. Talk to your supervisor if you begin to feel over-tired. Fatigue leads to accidents.

No tree work should be done after dark without adequate lighting.

Ice

Ice and snow present obvious slipping hazards when climbing. When temperatures are below freezing, inspect the upper side of the tree's limb before walking on it.

Trees with ice on the trunks or limbs should be climbed only when absolutely necessary.

Wet Limbs

Climbing wet trees, or in the rain, presents work hazards, such as visibility problems and slipping.

In addition to being slick, wet trees make defects harder to see. Inspect carefully before climbing, and climb wet trees only when necessary!

Windthrow

When trees are windthrown, the trunk is usually cut near the base. The stump and attached root plate may remain in the uplifted position, it may move part of the way back into the hole, or it may spring totally back into the hole. Care must be taken to make sure no one will be injured if the root plate moves. Movement may also throw the saw up and out-of-control.

Many limbs and saplings are put under great tension when a large tree falls on them. These "spring poles" need to be cut carefully using a special technique described in "Safe Tree Felling" to avoid a violent reaction to cutting.

Lowering Limbs

When lowering limbs, the shock load created by the falling piece of wood can be many times greater than the weight of the wood. This creates major problems when lowering off decayed, cracked or otherwise weakened wood.

Reduce stress on lowering lines and limbs by:

- Cutting smaller-than-normal sections of wood;
- Lowering off of lower, stronger limbs;
- Using false crotches on solid wood;
- Double crotching of lowering lines;
- Reinforcing weak crotches (e.g. wrapping with webbing sling) prior to lowering;
- Using specialized lowering devices.

Palms

Climbers have been injured and killed by frond skirts that became dislodged and fell on them while they were supported by a lanyard below the skirt. Therefore, when working in palms containing skirts with three or more years' worth of dead fronds, the climber must be supported by a climbing line and false crotch.

Dead fronds are a serious fire hazard. Smoking while working in or near dead palm fronds is prohibited. Also check the chain saw muffler to make sure it is intact and not releasing sparks.

Handle fronds with care as they can inflict serious cuts and puncture wounds that can result in infection.

Be aware that many types of animals (e.g. rats, snakes, bees, etc.) nest in palms, especially palms that have been neglected for several years. Have an escape plan in mind in case of attack!

Non-Tree Hazards

The following non-tree hazards need to be assessed.

Electric Wires

Before climbing any tree, a careful inspection must be made to locate possible electrical hazards. All wires passing through a tree should be considered energized.

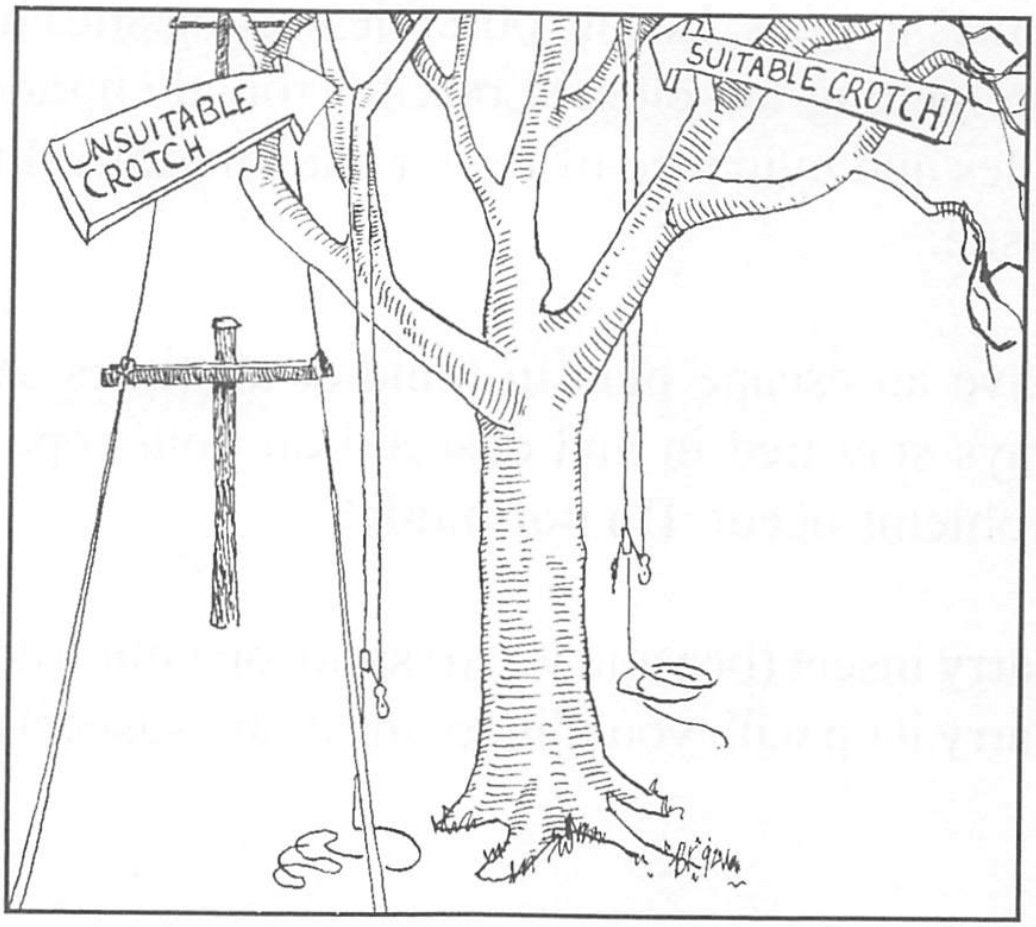


Fig. 15. Never underestimate electrical hazards.

Only a qualified line-clearance tree trimmer or qualified line-clearance tree trimmer trainee may perform the work if an electrical hazard exists.

The qualified line-clearance tree trimmer should climb the side of the tree opposite those conductors and select a crotch that will swing him or her away from the conductors.

Bees, wasps, animals

Many animals and stinging insects make their homes in trees. Locate possible nesting sites before getting too close. Look for round entrance holes and evidence of recent chewing of callus tissue.

Have an escape plan in mind at all times. Always stay tied in and descend on your rope if problems occur. **Do not panic!**

Carry insect (bee and wasp) spray on your truck. Carry it up with you if insect nests are suspected.

Fig. 16. Bees and wasps are always hazardous! They can be deadly when disturbed.

For large insect nests, hydraulic insecticide sprayers, bee-resistant suits or other techniques may be necessary.

Remember that most stinging insects are not active until the temperature becomes warm. They are less active in the morning than later in the day.

Support Cables

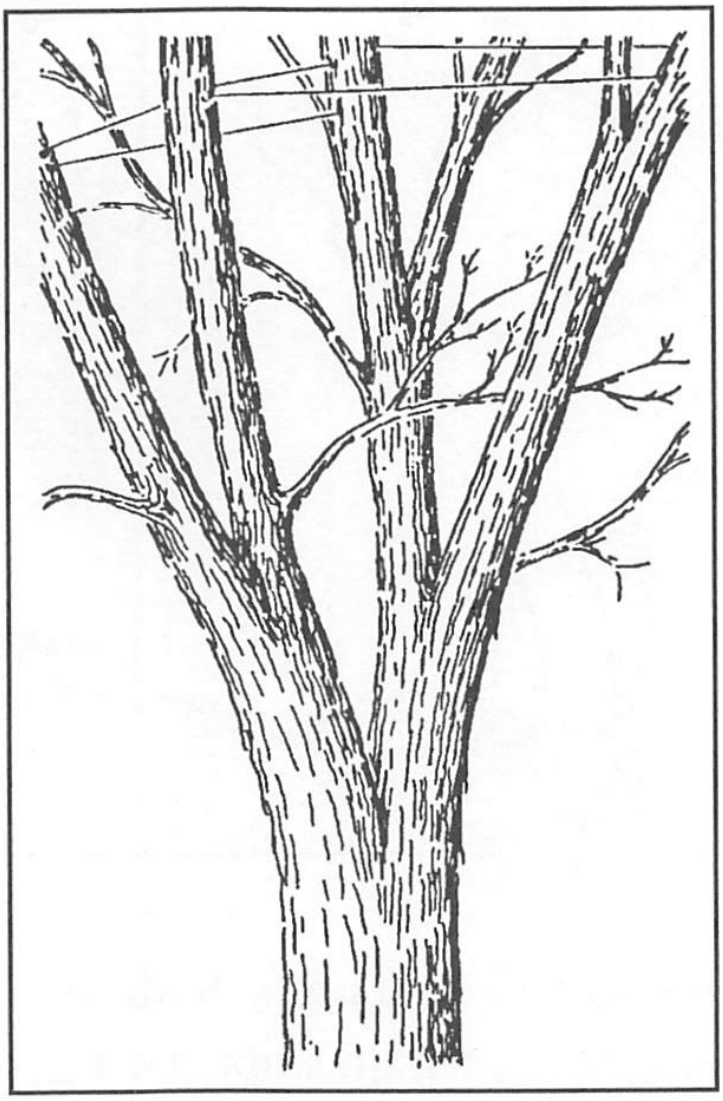


Fig. 17. Cables could indicate structural weaknesses.

Before performing any tree care operation, locate the position of any support cables. Cables are most common where V-crotches are present, but they may be in any tree.

Check cable tension and condition of branches being supported before removing the cables.

Conclusion

After a tree dies, the wood begins to weaken. If left alone, all dead trees will eventually start dropping limbs, roots will start decaying and the trunk will eventually fall over.

How long is it between when a tree dies and when it is unsafe to climb?

There is no simple answer to this question. All trees must be judged individually based on the amount of root rot, trunk rot and limb deterioration. As a general rule, soft-wooded or decay-prone species are best removed within six months of their death. Stronger-wooded, less decay-prone species may last up to two years before climbing becomes highly risky.

Trees that weaken rapidly need to be removed soon after their death or specialized equipment must be used.

Trees that are weak-wooded or have rapidly weakening limbs or trunks:

Basswood/linden
Boxelder
Birch
California bay laurel
Cottonwood
Elm
Fir
Giant sequoia
Horsechestnut/buckeye
Poplar
Red maple
Redwood
Silver maple
Soft pines (5 needle)
Spruce
Sycamore maple
Tree of Heaven
Tulip poplar
Willow

To Climb Or Not To Climb?

GENERAL RULE

When you do not feel that you can work safely in a tree, you should not climb the tree.

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