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Photographic Guide of Selected External Defect Indicators and Associated Internal Defects in Sugar Maple

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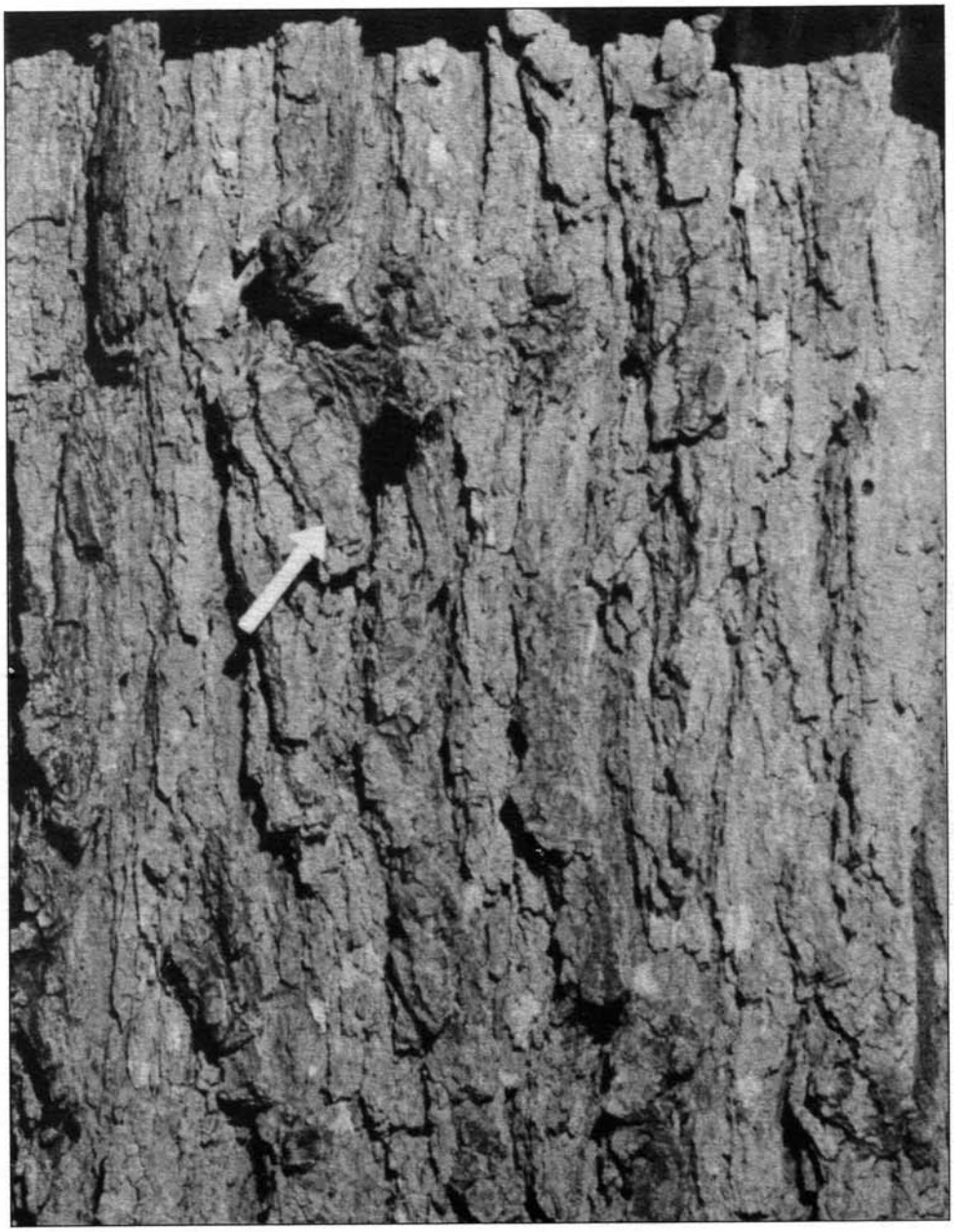

Abstract

To properly classify or grade logs or trees, one must be able to correctly identify indicators and assess the effect of the underlying defect on possible end products. This guide assists the individual in identifying the surface defect indicator and shows the progressive stages of the defect throughout its development for sugar maple. Eleven types of external defect indicators and associated defects that are particularly difficult to evaluate are illustrated and described.

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Introduction

This photographic guide on sugar maple is the sixth in a series designed to assist in the understanding of the relationship between exterior defect indicators and the underlying defect. In this study, like the previous studies on black walnut (Rast et al. 1988), white oak (Rast et al. 1989), and yellow-poplar (Rast et al. 1990), bolts were sliced and photographs of the interior defects were taken at the USDA Forest Service's Forest Products Laboratory in Madison, Wisconsin. In this publication we provide a stereo pair of photographs of the defect indicators to give the user a more realistic view.

Procedure

Thirteen sugar maple trees on the Florence Hanger District of the Nicolet National Forest in northeastern Wisconsin were selected, felled, and bucked into twenty five 4-foot bolts containing the defects to be studied. Many of the bolts contained two or more defects. The bolts were carefully transported to a warehouse to be photographed. This controlled environment enabled us to take quality photographs of defect indicators and provided a good storage area for the bolts until the film was developed and the photos checked.

The ends of the bolts were marked off in quadrants using the geometric center as the midpoint. The quadrants were aligned to keep all the defects in quadrant 1 or 2, if possible. A 1-inch groove was routed along the 3-4 quadrant line, providing an identification mark in the rotary-cut veneer for clipping. By clipping at this point, each sheet of veneer was one complete revolution of the log. This provided a method for identifying the correct defects corresponding to the surface defect indicators that were photographed.

Prior to slicing, the bolts were steam-heated in a water vat just enough to loosen the bark. Next, the bolts were debarked by hand, replaced in the vats, and heated to the correct slicing temperature. A bolt was then removed from the vat, chucked in the lathe, and rotary sliced into 1/10-inch-thick veneer. Before getting a continuous sheet of veneer, the round-up pieces of veneer were counted and those necessary for photographing were saved. Once it began coming off in a continuous sheet, the veneer was clipped at the notch in the small end and stacked by bolts. The bolt number was put on the first and last sheet of veneer to identify each bolt. Only 10 to 15 bolts were sliced at a time so the defects could be photographed the same day to prevent stain or discoloration. Then the veneer was put in cold storage before drying.

Discussion of Defects

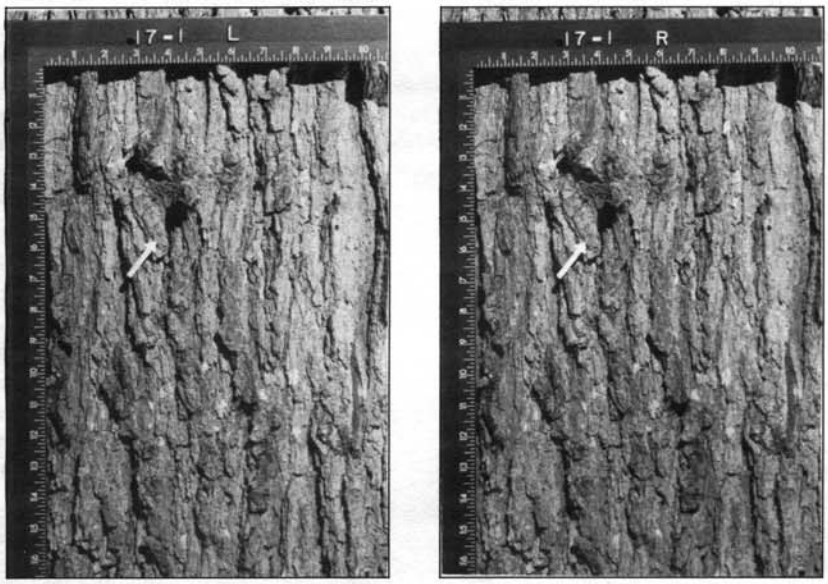
The defect indicators reported in this publication are: suppressed bud; suppressed bud cluster; open and occluded (closed) bird peck; light, medium, and heavy bark distortions; new and old wounds; surface rise; and burl. We believe that these indicators often are difficult to identify and evaluate in terms of their effect on end-product quality. Graders normally have little difficulty recognizing and evaluating the obvious grading defects such as limbs, forks, bumps, and butt scars.

The photo format for each defect evaluated in this publication is, first, a pair of stereo photographs of the defect indicator on the log surface. Next is an enlarged set of prints showing the defect indicator followed by a series of prints of the actual defect as it appears at different depths below the log surface. Below the photo of the defect indicator (Fig. 1) is a list that describes the size of the defect in terms of length (along the grain), width (across the grain), and height (above the normal bark contour); log diameter, inside the bark (ib) at the defect; round-up thickness; core diameter; and distance of defect above the stump. The information listed below the interior defect (Fig. 1) indicates distance below the log surface (inside the bark) as well as the distance from the first slice of veneer to that particular photographed defect. The last photograph in each defect series also lists total veneer thickness, which is the distance from the initial slice of usable veneer to the veneer core.

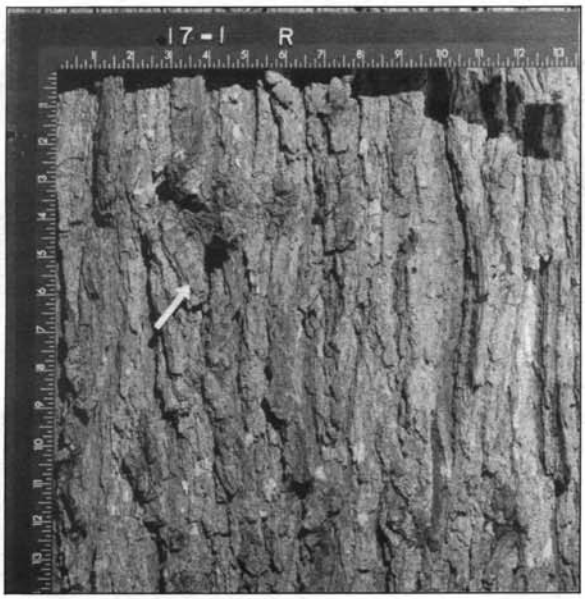
Suppressed Buds

Epicormic branches develop from two types of buds: suppressed or dormant buds and adventitious buds (Kormanik and Brown 1969 and Shigo 1986). **Suppressed buds** (Figs. 1 and 2) can persist for many years as a bud trace or they can sprout suddenly after some stimulus such as thinning or damage to the tree. After sprouting, many develop into small limbs that often die. In contrast, bud traces usually continue to form in the cambial zone even after the epicormic limb dies and eventually drops off (Fig. 1), sometimes forming another epicormic limb which may or may not develop. Occasionally the suppressed bud may cease all activity in the cambial zone following its occurrence, showing no evidence of the bud trace (Fig. 2). By contrast, adventitious buds form anew from the cambium, usually following injury to the tree. The defect indicator for both bud types is identified by a slight break in the bark pattern with a small protuberance in the center.

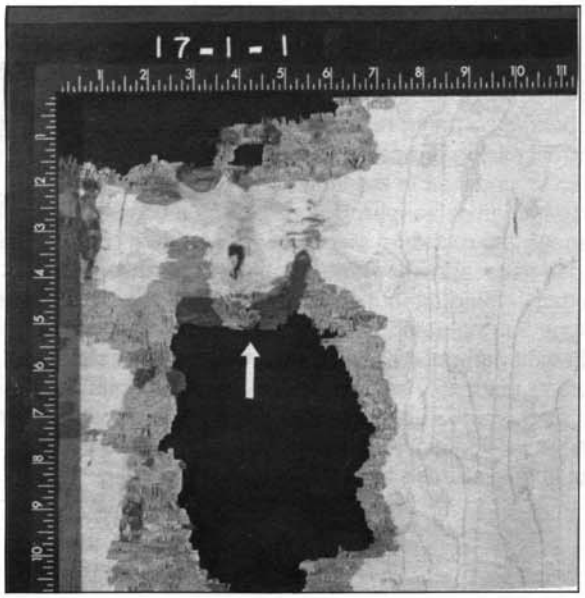
Figure 1.—Suppressed bud and associated internal defects.



Stereo view of defect indicator



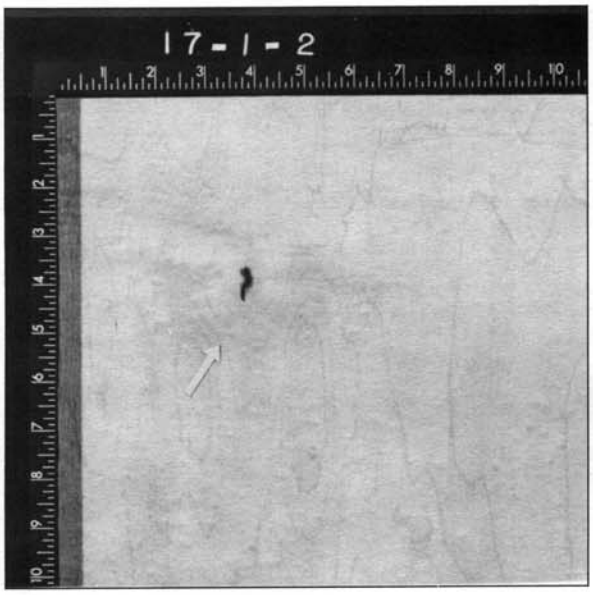
Defect size	½ × ½ inches
Log diameter at defect (ib)	22.1 inches
Round-up thickness	0.5 inch
Core diameter	5.7 inches
Defect distance above stump	5.5 feet



Depth below—

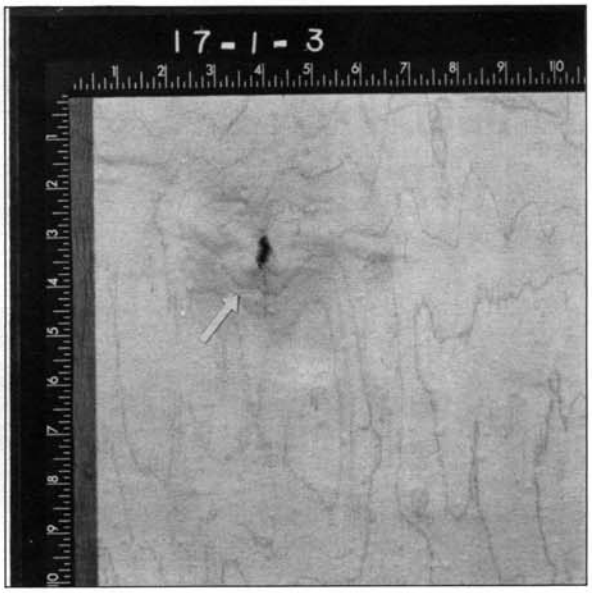
Log surface	0.5 inch
First sheet of veneer	0.0 inch

Figure 1 (Continued)



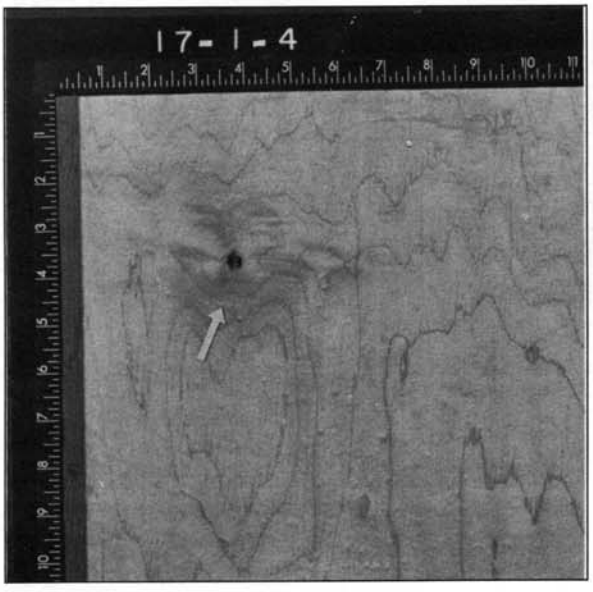
Depth below—

Log surface . . . . . 1.5 inches
First sheet of veneer . . . . . 1.0 inch



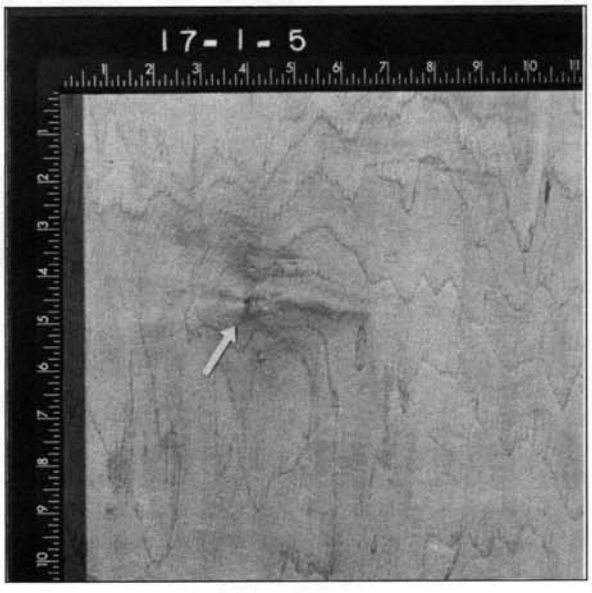
Depth below—

Log surface . . . . . 2.5 inches
First sheet of veneer . . . . . 2.0 inches



Depth below—

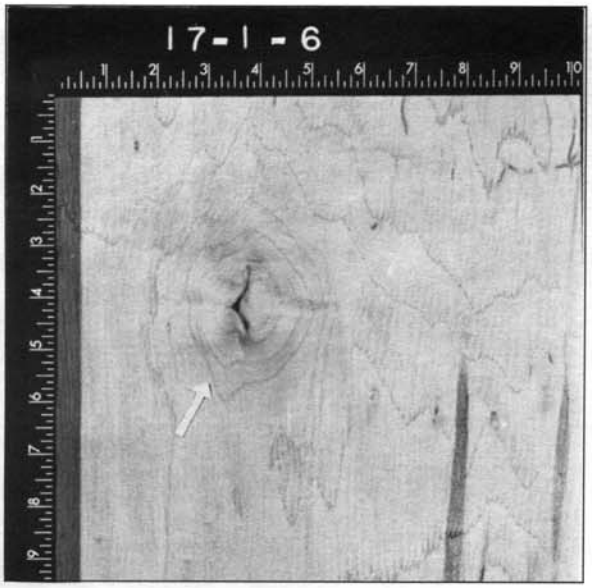
Log surface . . . . . 3.5 inches
First sheet of veneer . . . . . 3.0 inches



Depth below—

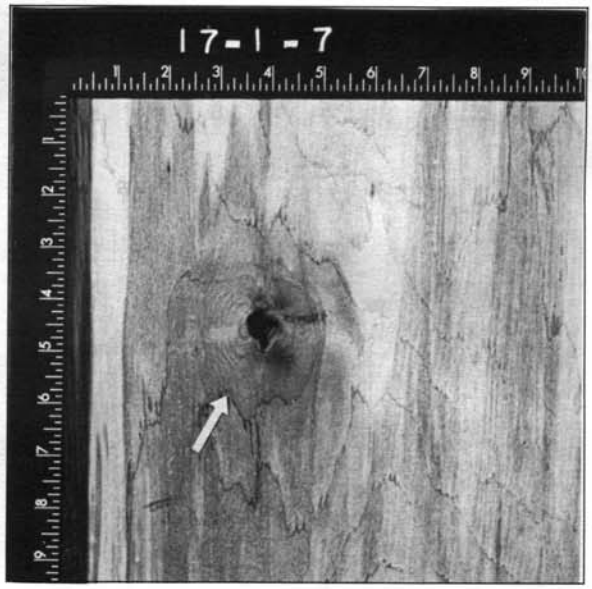
Log surface . . . . . 4.5 inches
First sheet of veneer . . . . . 4.0 inches

Figure 1 (Continued)



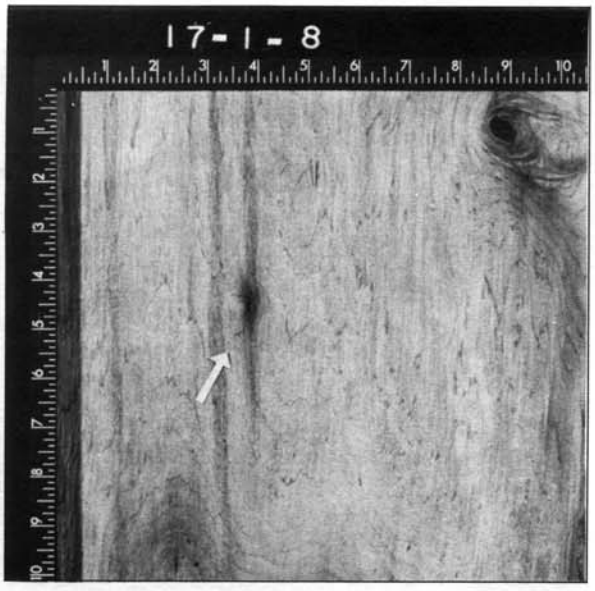
Depth below—

Log surface	5.5 inches
First sheet of veneer	5.0 inches



Depth below—

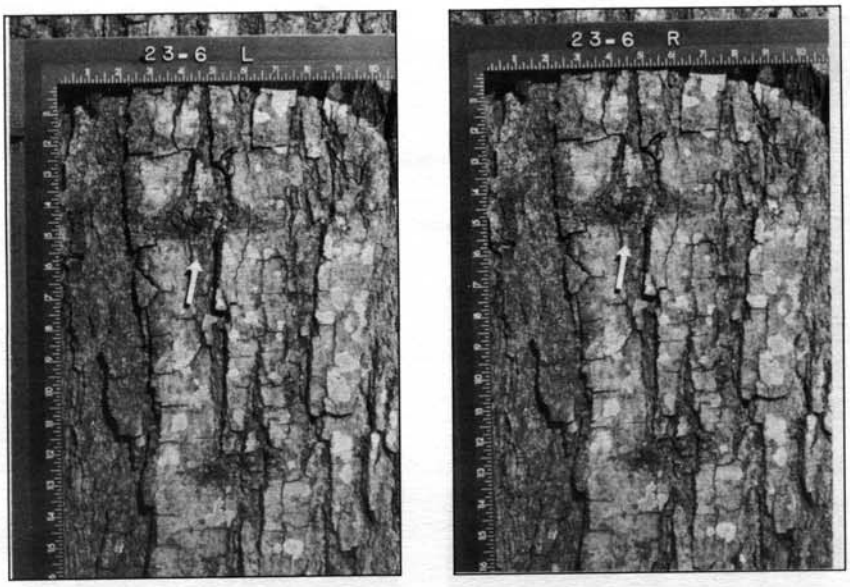
Log surface	6.5 inches
First sheet of veneer	6.0 inches



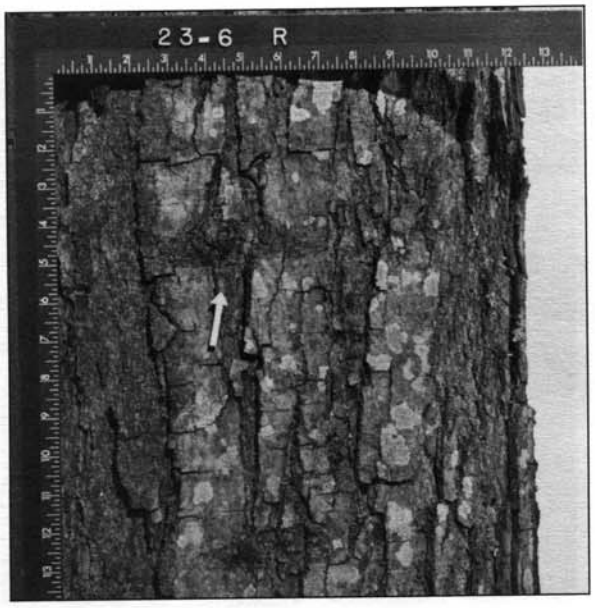
Depth below—

Log surface	8.5 inches
First sheet of veneer	8.0 inches
Total Veneer Thickness	8.0 inches

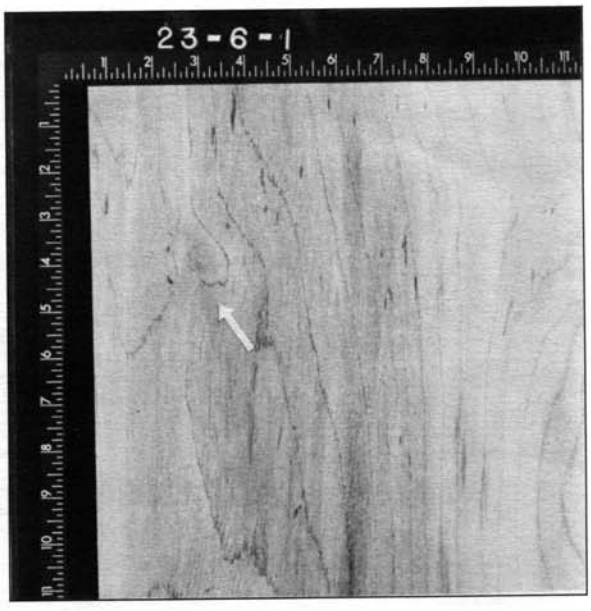
Figure 2.—Suppressed bud and associated internal defects.



Stereo view of defect indicator



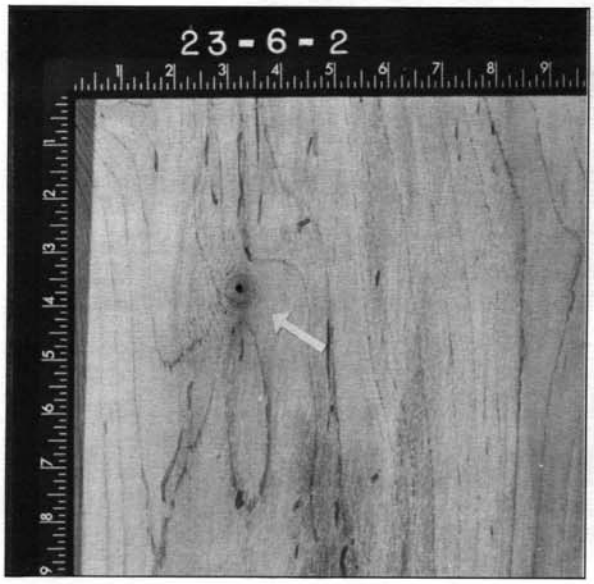
Defect size	½ × ½ inches
Log diameter at defect (ib)	16.2 inches
Round-up thickness	0.3 inch
Core diameter	5.8 inches
Defect distance above stump	13.5 feet



Depth below—

Log surface	4.8 inches
First sheet of veneer	4.5 inches

Figure 2 (Continued)



Depth below—

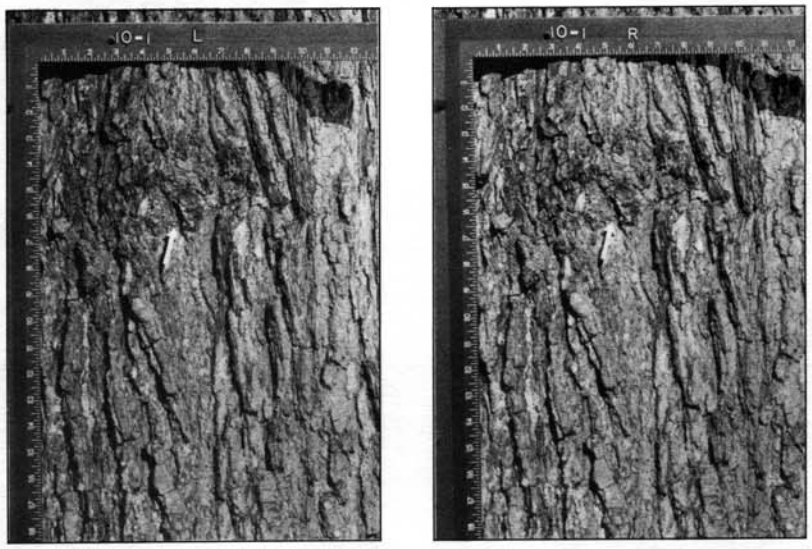
Log surface	5.3 inches
First sheet of veneer	5.0 inches
Total Veneer Thickness	5.0 inches

Suppressed Bud Cluster

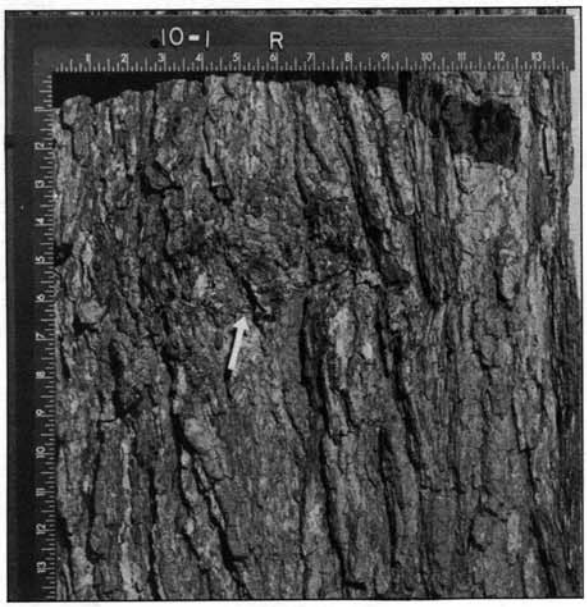
As its name implies, a **suppressed bud cluster** is a group of suppressed buds (3 to 20) tightly clustered in a small area, normally less than 2 by 2 inches in size. Usually, there is evidence of concentric rings around the defect indicator.

Figure 3 shows a faint evidence of the concentric rings around the defect indicator and the presence of several individual buds. Also, several adventitious knots are visible in the defect photos.

Figure 3.—Suppressed bud cluster and associated internal defects.



Stereo view of defect indicator

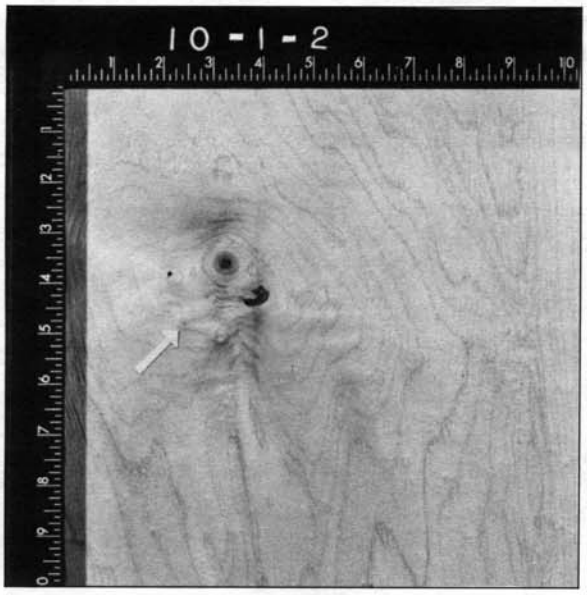


Defect size	1½ × 1½ inches
Log diameter at defect (ib)	18.1 inches
Round-up thickness	0.0 inch
Core diameter	5.9 inches
Defect distance above stump	5.5 feet

Depth below—

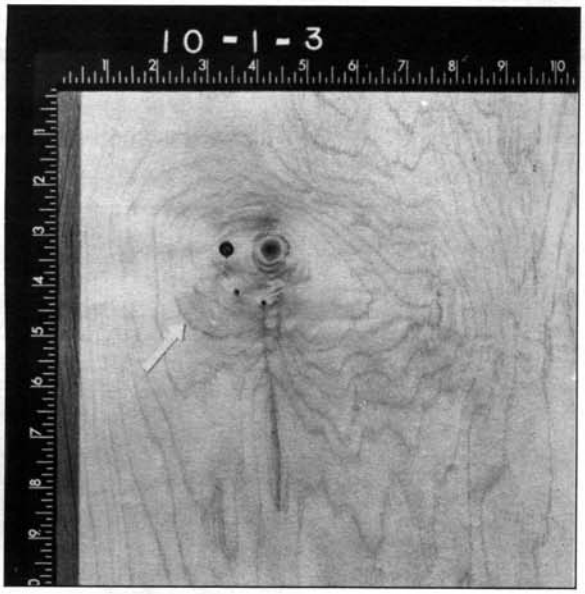
Log surface	0.5 inch
First sheet of veneer	0.5 inch

Figure 3 (Continued)



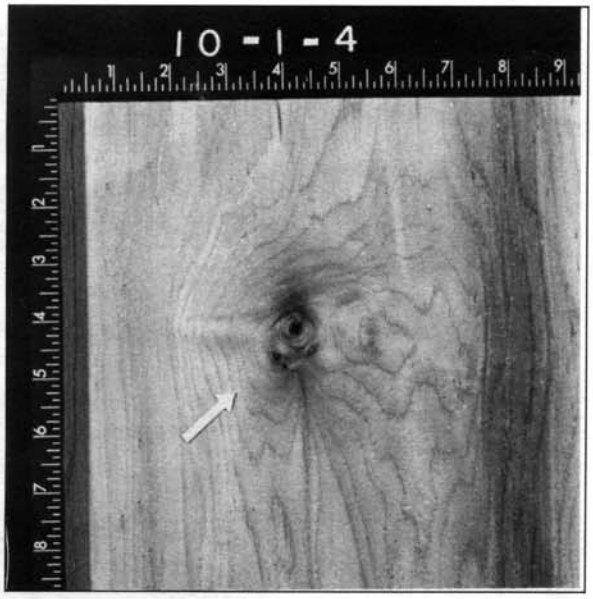
Depth below—

Log surface	2.0 inches
First sheet of veneer	2.0 inches



Depth below—

Log surface	4.0 inches
First sheet of veneer	4.0 inches



Depth below—

Log surface	6.0 inches
First sheet of veneer	6.0 inches

Depth below—

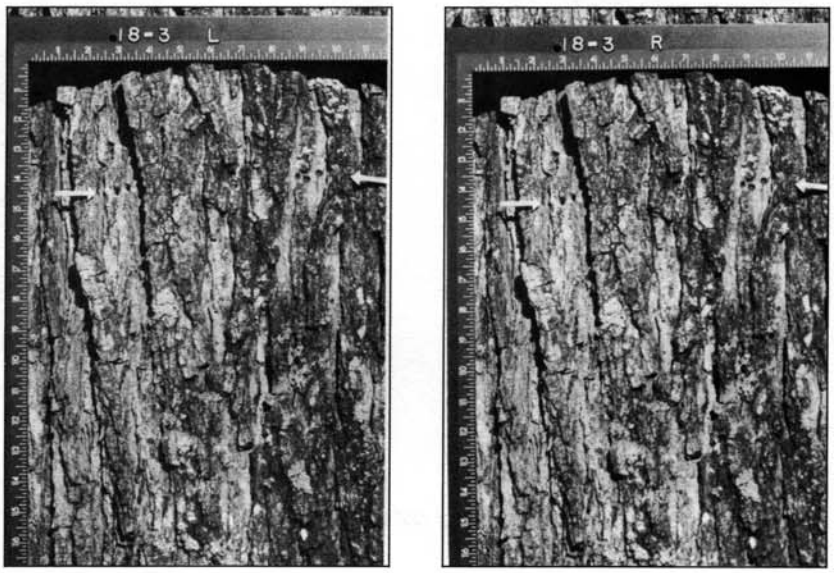
Log surface	7.0 inches
First sheet of veneer	7.0 inches
Total Veneer Thickness	7.0 inches

Bird Peck

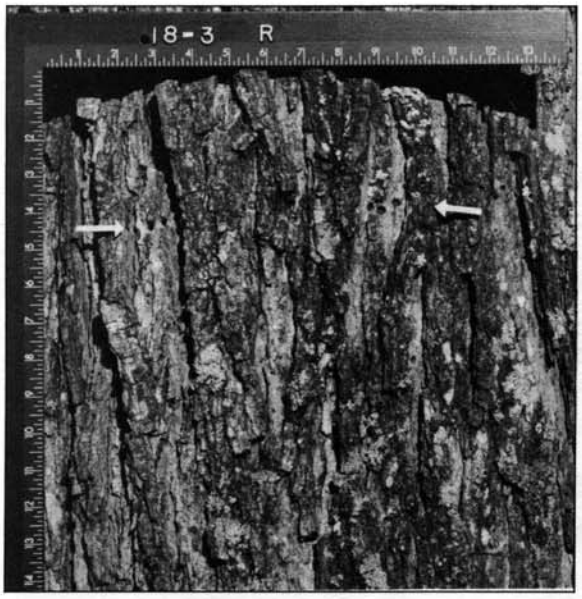
Bird peck is evaluated by determining whether callus tissue is formed in the peck holes (Rast et al. 1973). If the peck holes are open, the pecks did not reach the cambium layer and there will be no damage. But if the peck holes are closed, there will be damage to the tree. Bird pecks are sometimes considered as old or new. However, this classification should not be used except to say that new bird pecks can be disregarded in grading logs and trees, whether or not they reach the cambium layer, so long as the tree is cut shortly after injury. The rationale is that the peck defects will be removed during the initial stages of primary processing (debarking, slabbing, or round-up) of the log.

Figure 4 shows primarily **open bird peck** that is not

Figure 4.—Open bird peck.



Stereo view of defect indicator

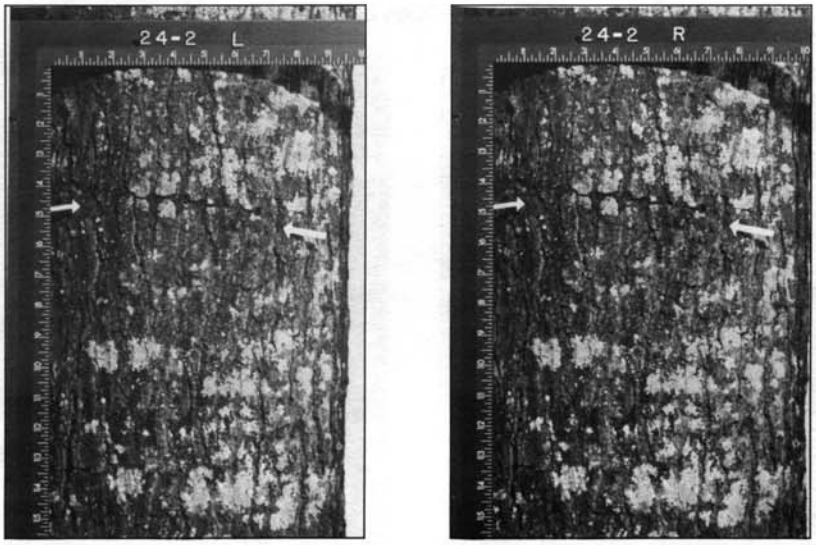


Defect size	1 × 8 inches
Log diameter at defect (ib)	20.3 inches
Round-up thickness	0.2 inch
Core diameter	5.8 inches
Defect distance above stump	10.0 feet

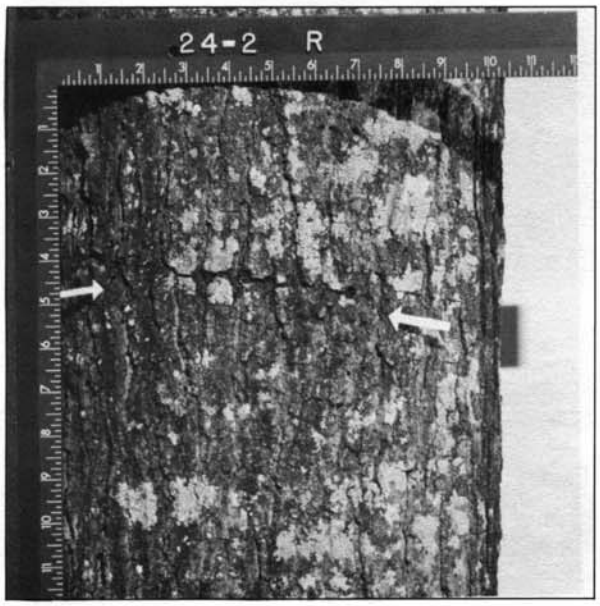
occluded (two next to the left arrow and one in the center of the photo) and, therefore, can be disregarded. However, careful examination of the photograph reveals several occluded bird pecks (between the two arrows). No photos of veneer defects were taken as the only indication of defects in the wood was these occluded bird pecks.

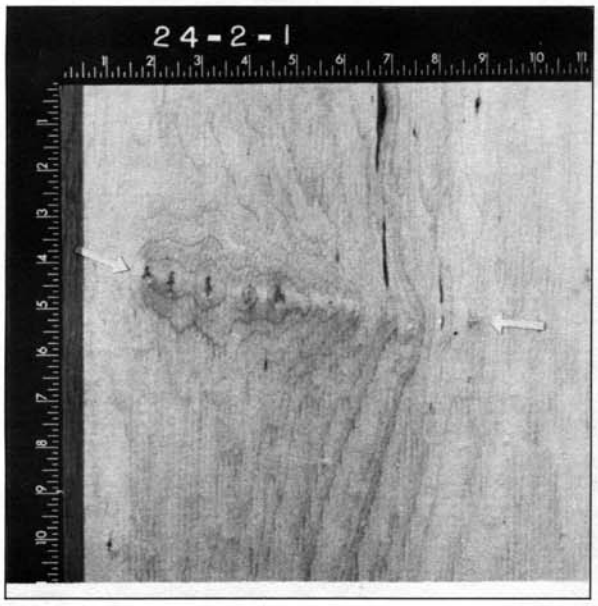
By contrast, in looking at the **occluded bird peck** in Figure 5, one can observe clearly the callus material in the pecked holes and the defects in the underlying wood. The accompanying stain is quite normal with occluded bird peck due to the easy entry of moisture and pathogens. Severe bird beck can lead to a separation of the wood along the rings.

Figure 5.—Occluded (closed) bird peck and associated internal defects.



Stereo view of defect indicator



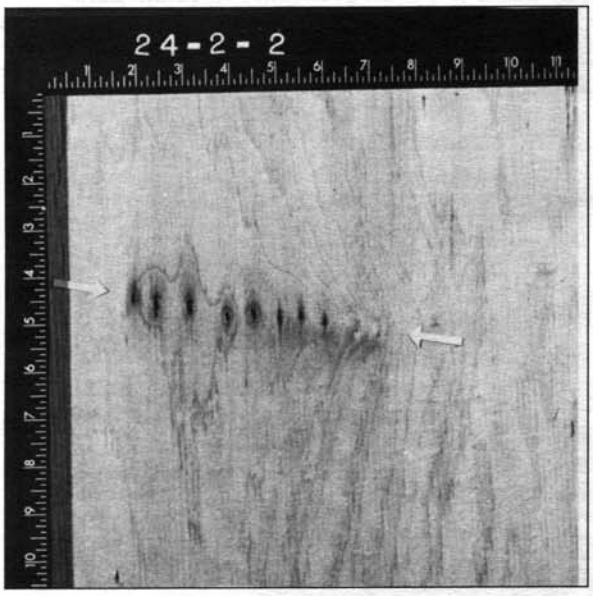


Defect size	1 × 9 inches
Log diameter at defect (ib)	11.7 inches
Round-up thickness	0.1 inch
Core diameter	5.6 inches
Defect distance above stump	5.0 feet

Depth below—

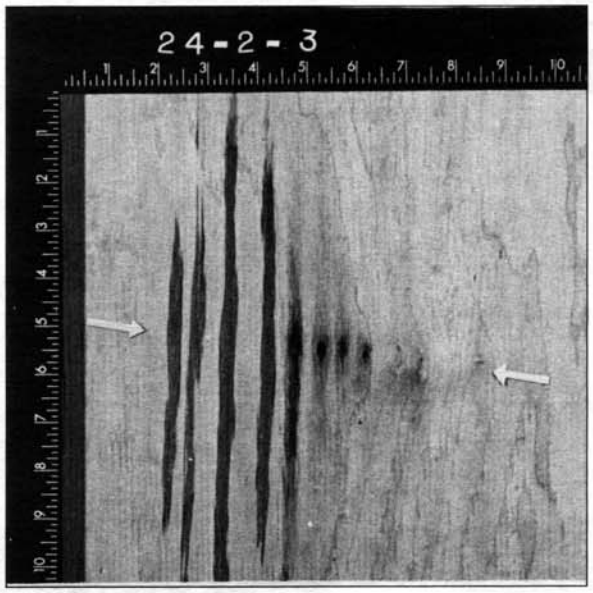
Log surface	0.6 inch
First sheet of veneer	0.5 inch

Figure 5 (Continued)



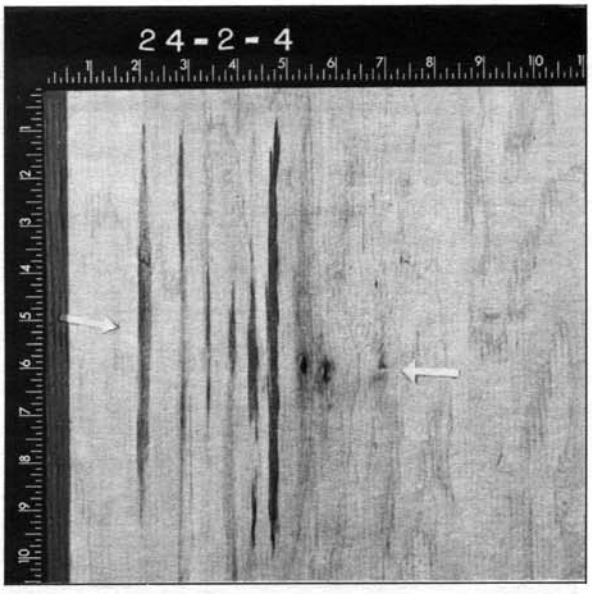
Depth below—

Log surface	0.9 inch
First sheet of veneer	0.8 inch



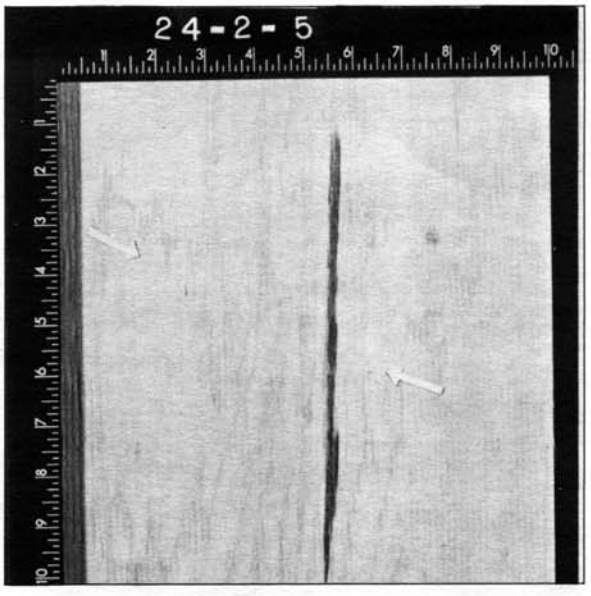
Depth below—

Log surface	1.1 inches
First sheet of veneer	1.0 inches



Depth below—

Log surface	1.3 inches
First sheet of veneer	1.2 inches



Depth below—

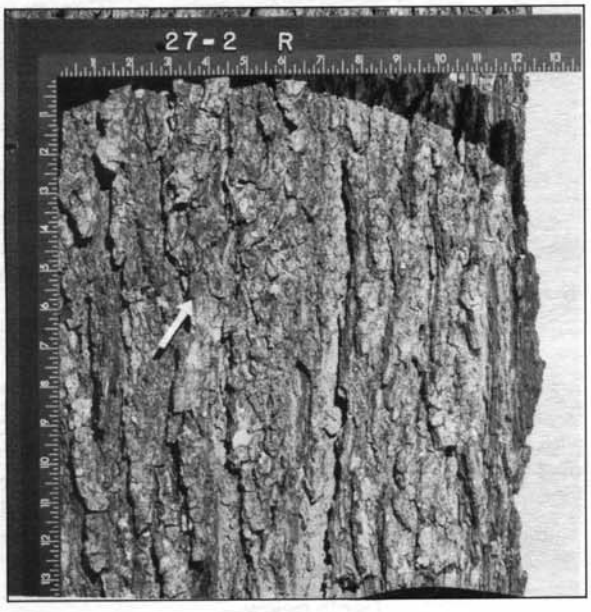
Log surface	1.8 inches
First sheet of veneer	1.7 inches
Total Veneer Thickness	2.9 inches

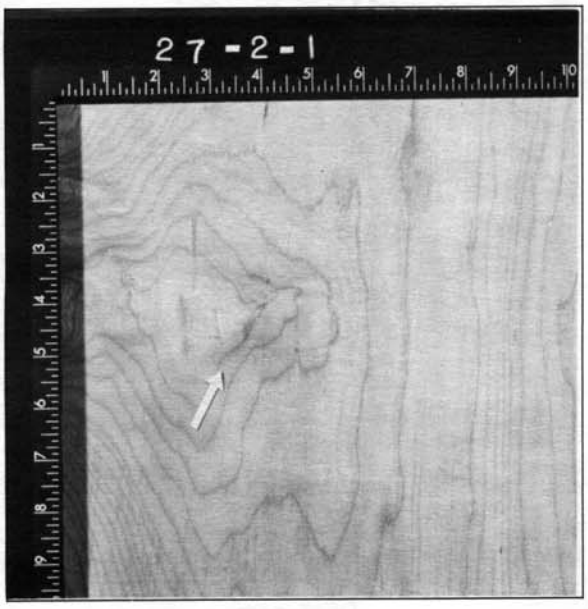
Bark Distortions

Bark distortions usually indicate an overgrown knot, and because of age they have no height measurement (flush with the normal contour of the bark). They are classified as light, medium, or heavy. A **light bark distortion** (Fig. 6) shows a slight amount of curvature in the surrounding bark plates, and the bark pattern varies only slightly from normal. Because of these features, light bark distortions are inconspicuous and often overlooked. **Medium bark distortions** (Fig. 7) show more of the concentric circles, but they are broken in several areas by flat bark plates or the

Figure 6.—Light bark distortion and associated internal defects.

Stereo view of defect indicator



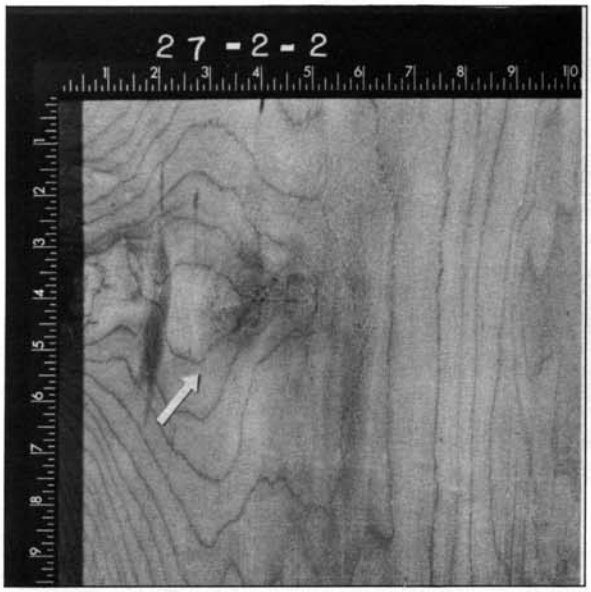


Defect size	2 × 2 inches
Log diameter at defect (ib)	16.4 inches
Round-up thickness	0.0 inch
Core diameter	6.2 inches
Defect distance above stump	7.0 feet

Depth below—

Log surface	4.0 inches
First sheet of veneer	4.0 inches

Figure 6 (Continued)



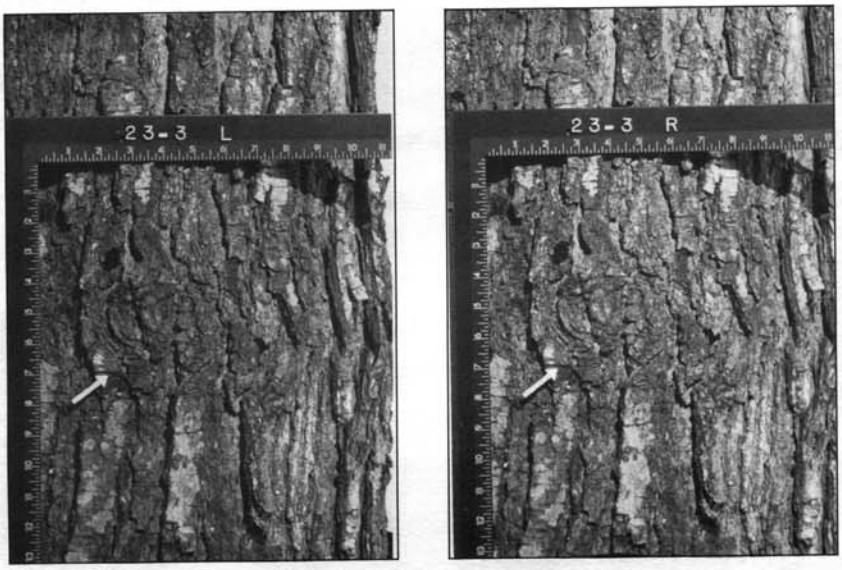
Depth below—

Log surface	4.5 inches
First sheet of veneer	4.5 inches

Depth below—

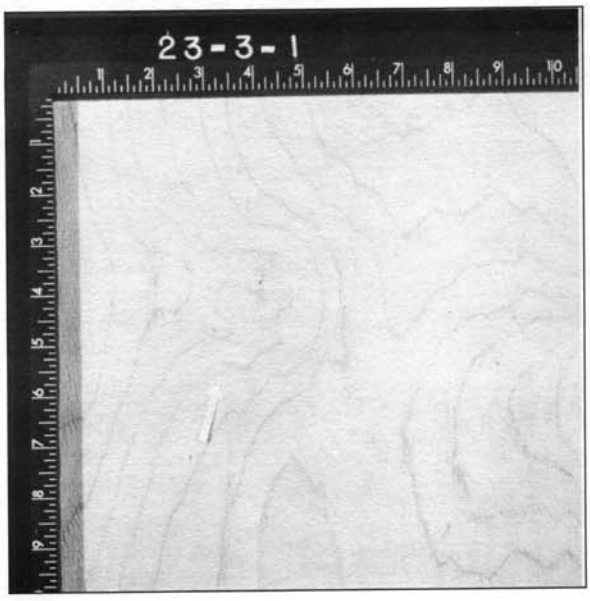
Log surface	5.1 inches
First sheet of veneer	5.1 inches
Total Veneer Thickness	5.1 inches

Figure 7.—Medium bark distortion and associated internal defects.



Stereo view of defect indicator

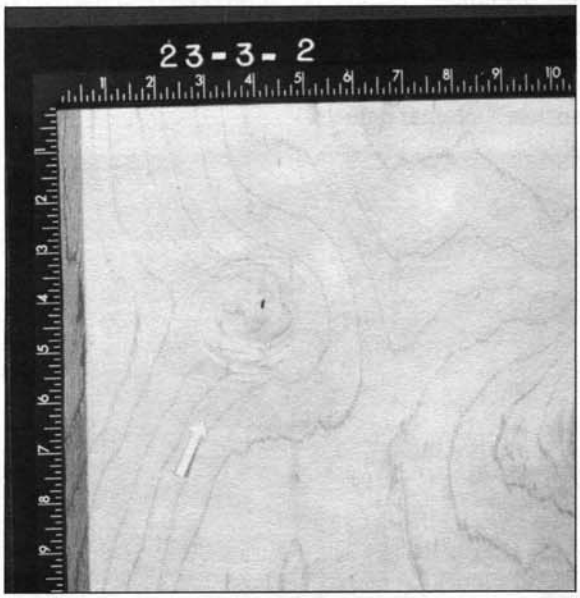
Defect size	3 × 3 inches
Log diameter at defect (ib)	15.8 inches
Round-up thickness	0.3 inch
Core diameter	5.8 inches
Defect distance above stump	11.5 feet



Depth below—

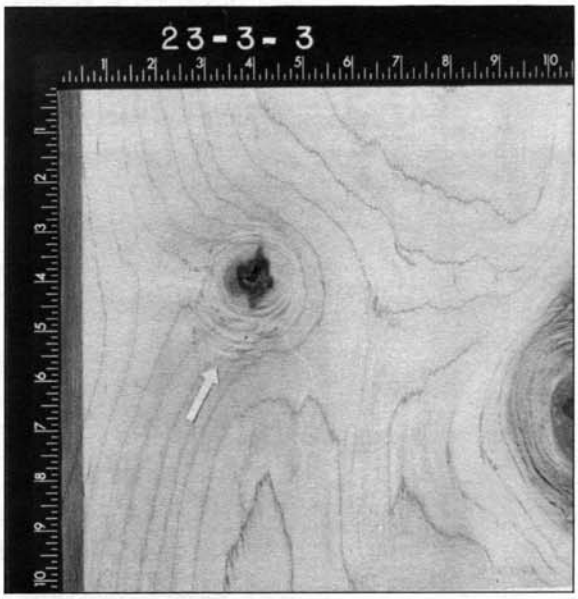
Log surface	2.8 inches
First sheet of veneer	2.5 inches

Figure 7 (Continued)



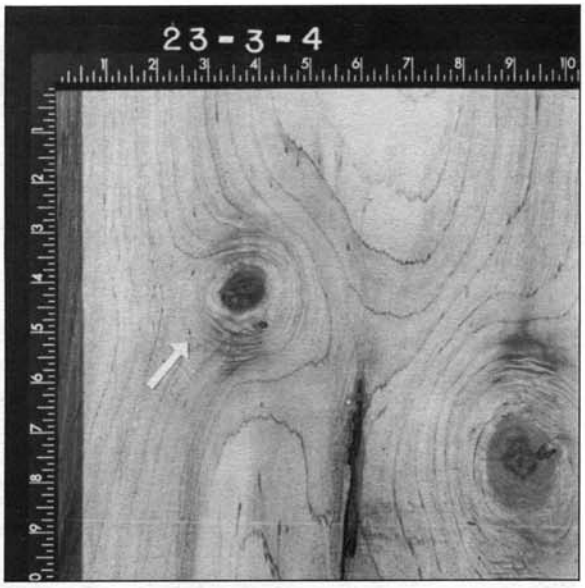
Depth below—

Log surface	3.8 inches
First sheet of veneer	3.5 inches



Depth below—

Log surface	4.3 inches
First sheet of veneer	4.0 inches



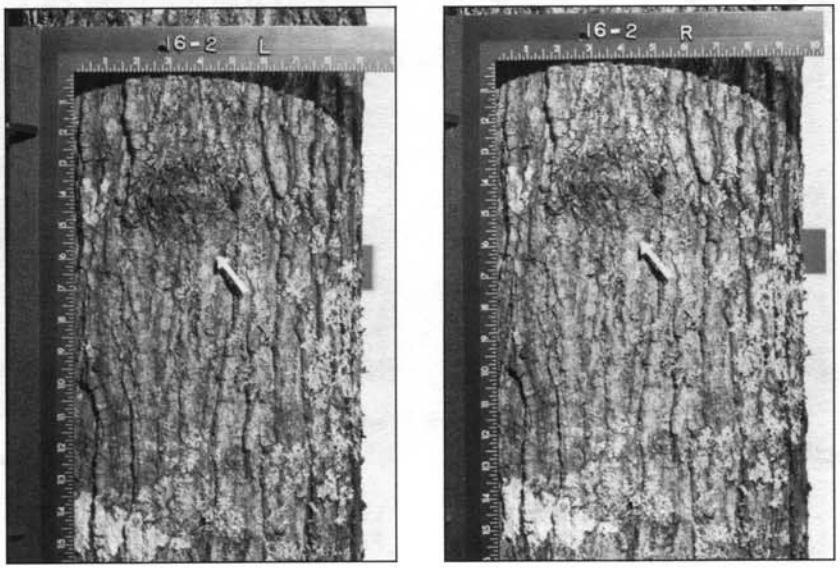
Depth below—

Log surface	5.3 inches
First sheet of veneer	5.0 inches
Total Veneer Thickness	5.0 inches

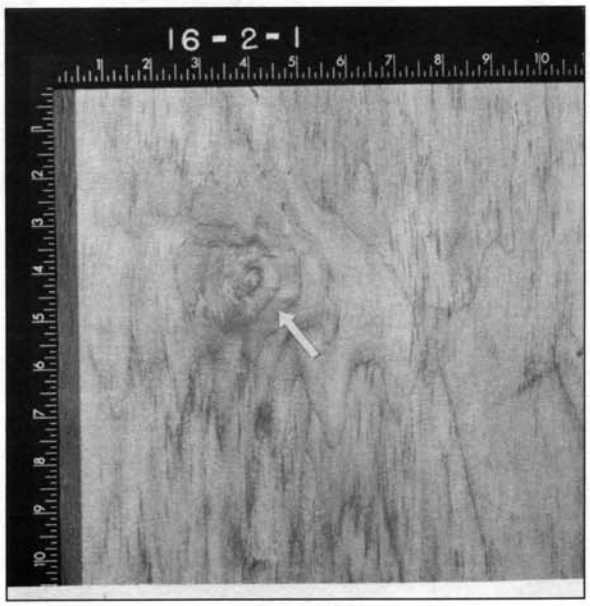
regular bark pattern running lengthwise through the defect indicator. Also present can be moderate to well-defined breaks in the bark pattern running radially from the outer edges to the center of the defect indicator. **Heavy bark distortions** (Fig. 8) are identified by the characteristic pattern of concentric circles encompassing the defect indicator and "pucker-like" appearance of the center.

All bark distortions result in some product degrade, but the amount of degrade decreases as the depth to the initial

Figure 8.—Heavy bark distortion and associated internal defects.



Stereo view of defect indicator



Defect size	2 × 2 inches
Log diameter at defect (ib)	11.5 inches
Round-up thickness	0.0 inch
Core diameter	5.6 inches
Defect distance above stump	19.0 feet

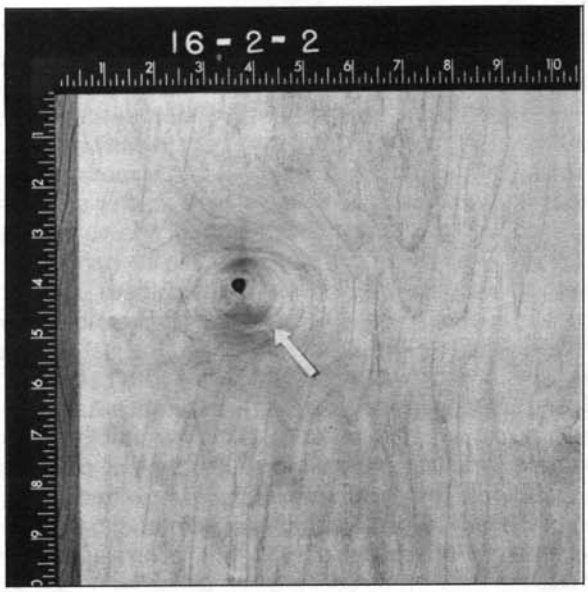
Depth below—

Log surface	1.0 inch
First sheet of veneer	1.0 inch

defect below the log surface increases. Light bark distortions, because of their greater depth below the log surface, are not considered defects in grading factory lumber logs, but medium and heavy distortions are.

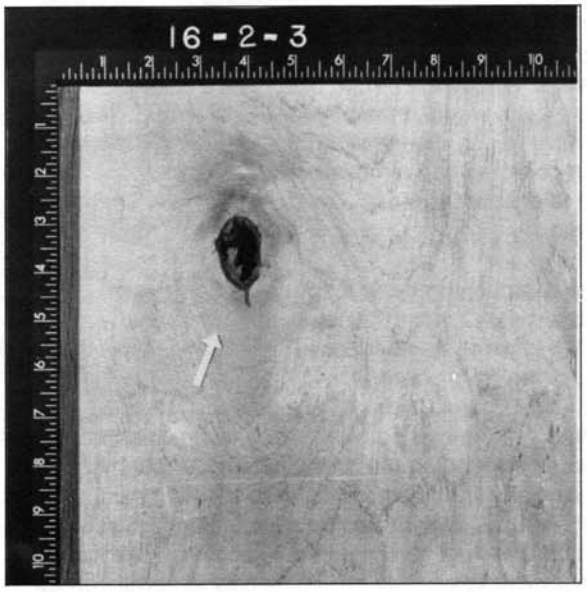
Likewise, many of the grading systems for veneer logs disregard light bark distortions. The clear area between the log surface and the defect is important in determining product suitability and, therefore, the log's economic value.

Figure 8 (Continued)



Depth below—

Log surface	2.0 inches
First sheet of veneer	2.0 inches



Depth below—

Log surface	3.3 inches
First sheet of veneer	3.3 inches
Total Veneer Thickness	3.3 inches

Sound Wounds

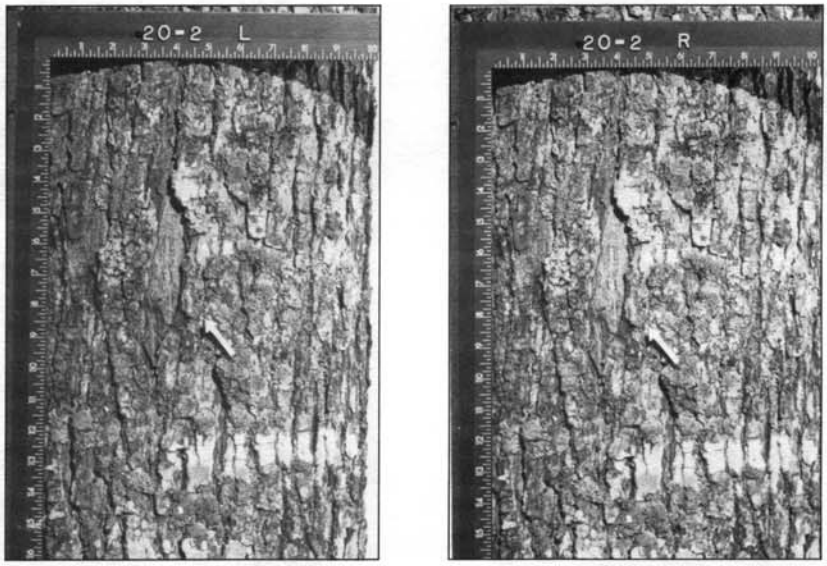
Wounds can originate from a wide range of causes—from an individual wielding a hatchet to a limb or another tree falling against the tree, or from damage to the tree during the felling and skidding phases of a logging operation. Wounds are classified as sound or unsound. Sound wounds may or may not be grade defects depending on their age and depth. If a wound is fresh and can be slabbed off during sawing, or if it is very deep and falls in the heart center of the log (Rast et al. 1973), then very little degrade results. Whether a wound becomes unsound depends on the type, severity, time of year of occurrence, tree species, and tree vigor. Sound wounds are further classified as new (the defect will be removed during slabbing or round-up) or old (the defect extends into the quality zone or the heart center).

The defect in Figure 9, a **sound wound (new),** probably was a clean, smooth removal of the bark and some wood on a fast-growing tree because the first and last evidence of the defect in the veneer is contained within eight-tenths of an inch. Figure 10 shows a **sound wound (old).** The primary difference between these wounds is that the callus tissue surrounding the "new" wound is rough or corky, can have many lines perpendicular to the long axis, and has only a slight ridge or pucker surrounding the seam running lengthwise through the defect indicator. Even the lengthwise seam may be visible only in certain areas. The bark plates surrounding the defect indicator usually are rough and jagged. By contrast, the callus tissue of the "old" wound has a "washed out" or more natural bark appearance, a smooth or nearly smooth surface, and more of a bark-like fissure running lengthwise through its center. The bark plates surrounding the defect indicator of the old wound are more rounded and smooth.

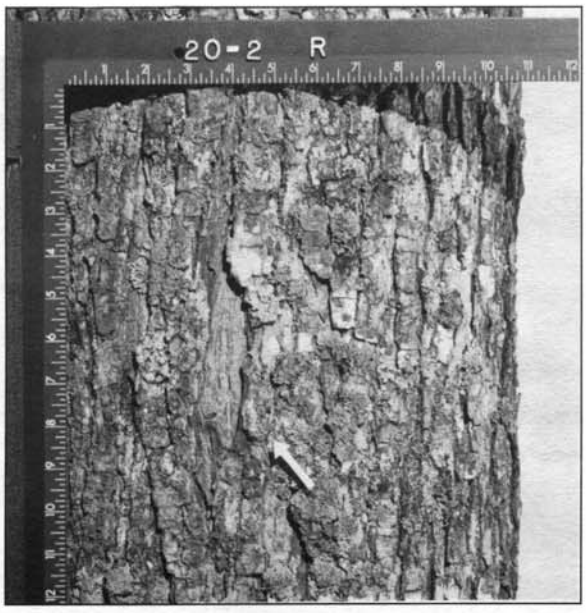
One problem for the inexperienced grader is distinguishing between distortions or overgrown knots and sound wounds. The major distinction between the defect indicators of distortions or overgrown knots and wounds is the lack of concentric circles and the oblong shape associated with wounds.

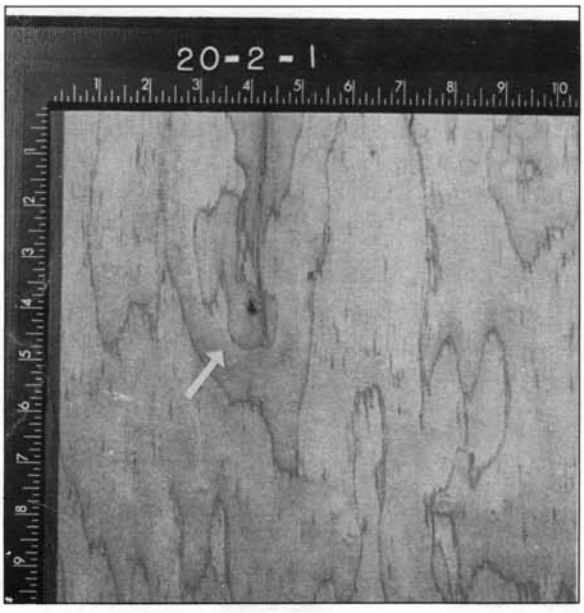
An uncommon wound encountered during this study is that caused by the felling of one tree against another during the period of active cambial growth (W.C. Shortle, USDA Forest Service, pers. comm. 1989). Trees are most susceptible to wounding from an object hitting the bark in early spring. The damage we noted ranged from 3 or 4 wounds to 25 wounds per tree, and these always were on only one side of the tree stem. They ranged in height from 5 to 40 feet above the ground and ranged in length from 3 to 12 inches. Figures 11 and 12 are typical examples of these defects. The first evidence of each of these defects was about one-half inch below the surface of the log and the last evidence of the defect in the wood generally was 1 inch below the surface of the log. Personnel with the Florence Ranger District confirmed that the felling in this area took place in 1984 during the last week of March and the first couple of weeks of April. The growth rate of the sample trees averaged about one-quarter inch per year and the study trees were cut in September 1987, which correlates with the fact that the deepest defects are approximately 1 inch below the surface of the log. Defects of this nature will be devastating to the quality of those trees affected, particularly during a selection cutting in which the remaining trees are in the intermediate and mature sawtimber size classes.

Figure 9.—Sound wound (new) and associated internal defects.



Stereo view of defect indicator



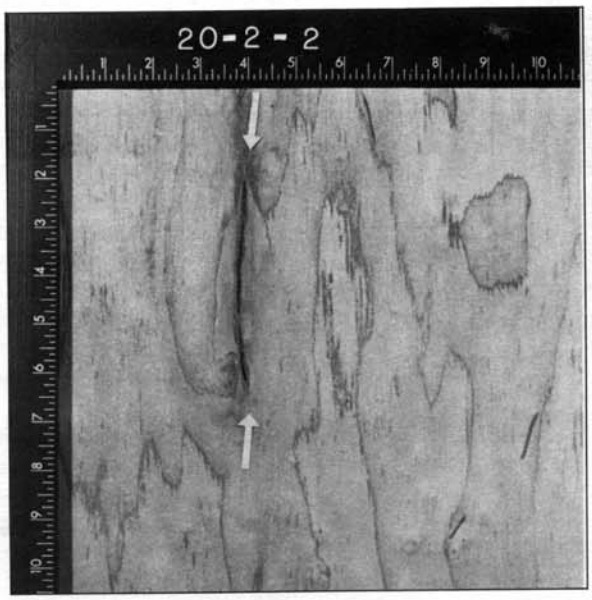


Defect size	5 × 1 inches
Log diameter at defect (ib)	13.9 inches
Round-up thickness	0.4 inch
Core diameter	5.7 inches
Defect distance above stump	7.0 feet

Depth below—

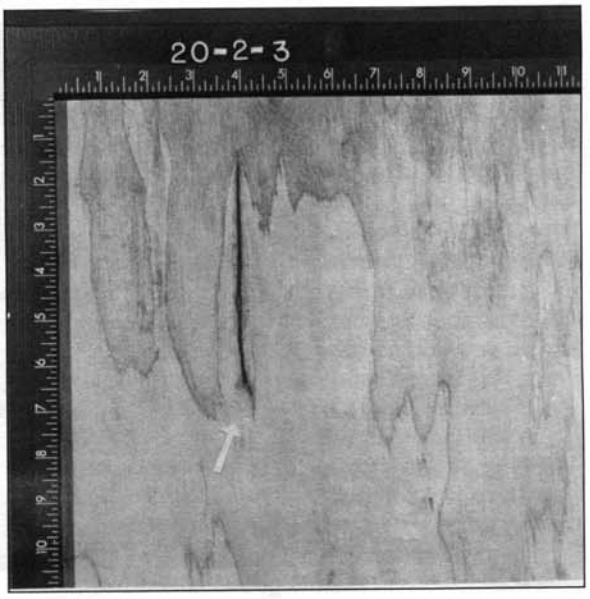
Log surface	0.9 inch
First sheet of veneer	0.5 inch

Figure 9 (Continued)



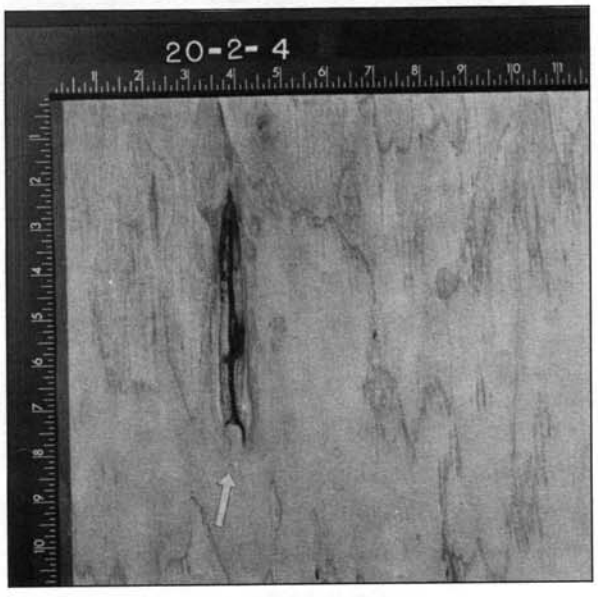
Depth below—

Log surface	1.1 inches
First sheet of veneer	0.7 inch



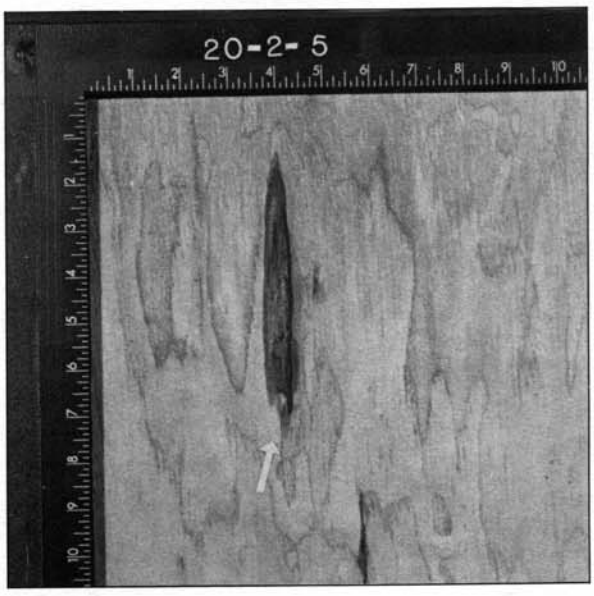
Depth below—

Log surface	1.4 inches
First sheet of veneer	1.0 inch



Depth below—

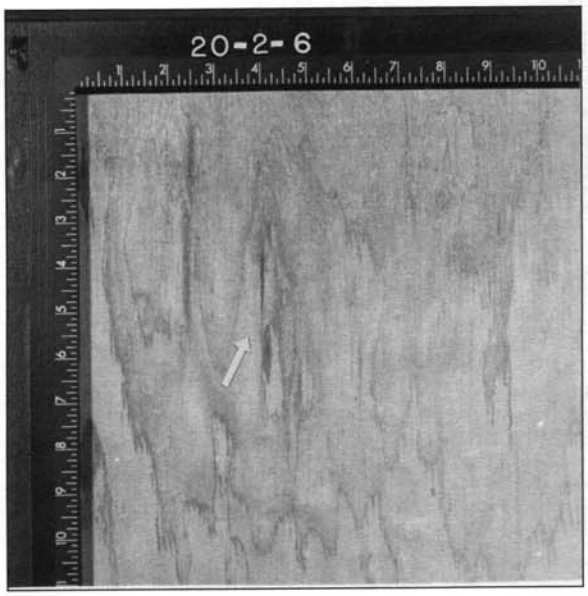
Log surface	1.5 inches
First sheet of veneer	1.1 inches



Depth below—

Log surface	1.6 inches
First sheet of veneer	1.2 inches

Figure 9 (Continued)



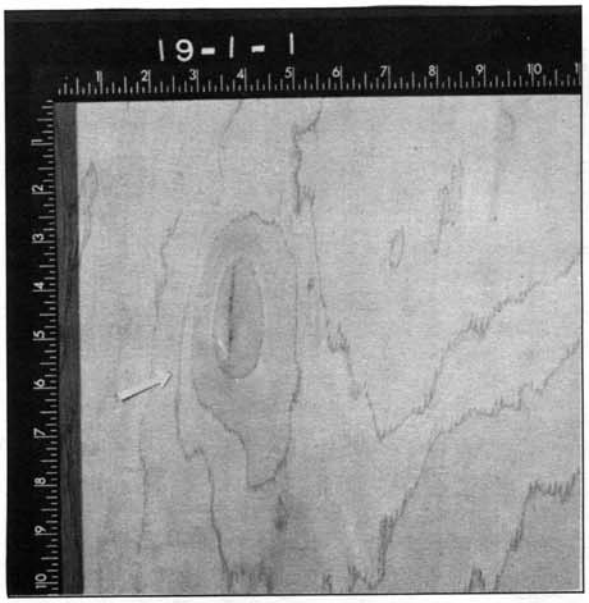
Depth below—

Log surface	1.7 inches
First sheet of veneer	1.3 inches
Total Veneer Thickness	4.0 inches

Figure 10.—Sound wound (old) and associated internal defects.

Stereo view of defect indicator

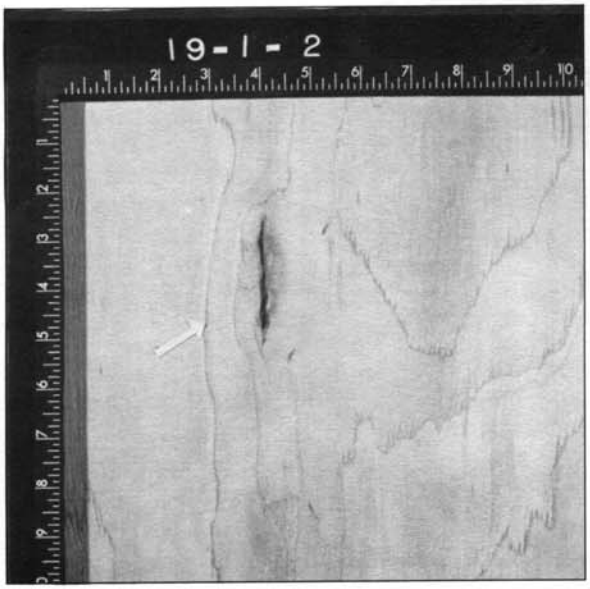
Defect size	6 × 1 inches
Log diameter at defect (ib)	14.9 inches
Round-up thickness	0.5 inch
Core diameter	5.8 inches
Defect distance above stump	3.5 feet



Depth below—

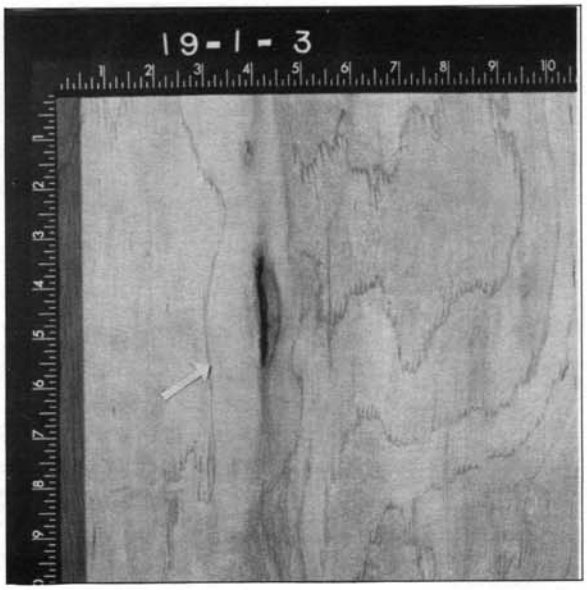
Log surface	3.0 inches
First sheet of veneer	2.5 inches

Figure 10 (Continued)



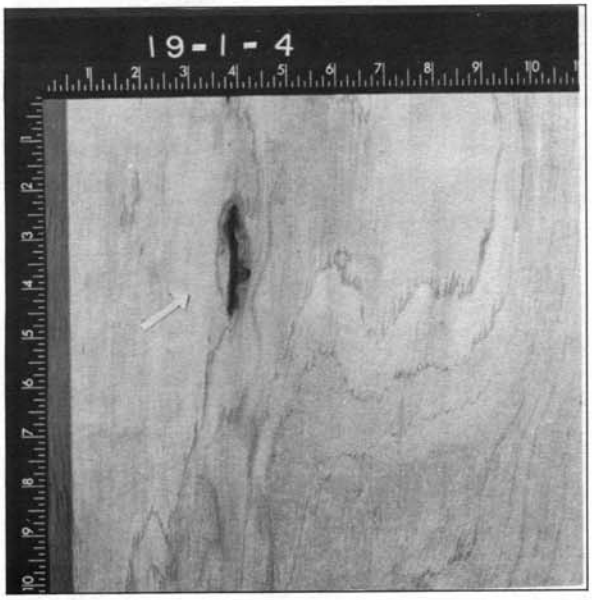
Depth below—

Log surface	3.5 inches
First sheet of veneer	3.0 inches



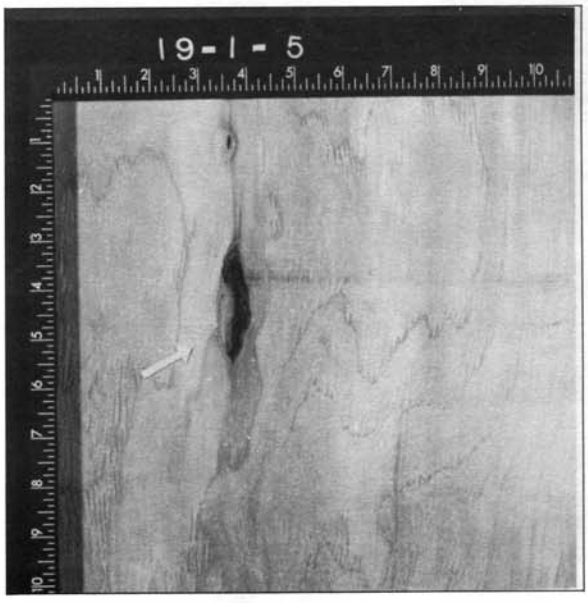
Depth below—

Log surface	3.8 inches
First sheet of veneer	3.3 inches



Depth below—

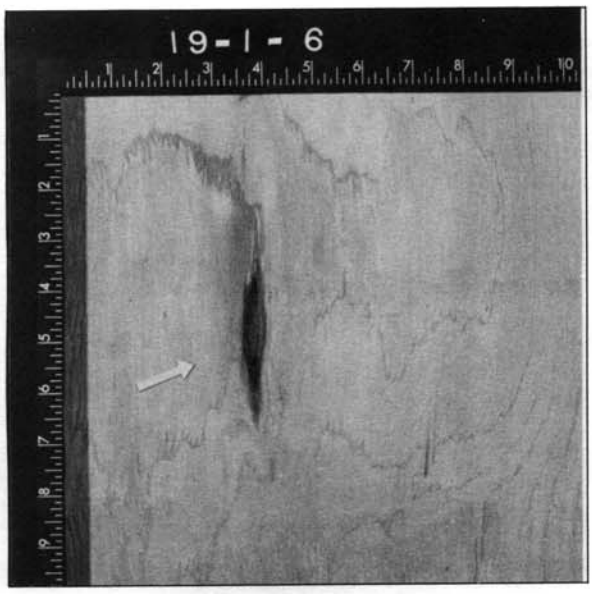
Log surface	3.9 inches
First sheet of veneer	3.4 inches



Depth below—

Log surface	4.0 inches
First sheet of veneer	3.5 inches

Figure 10 (Continued)

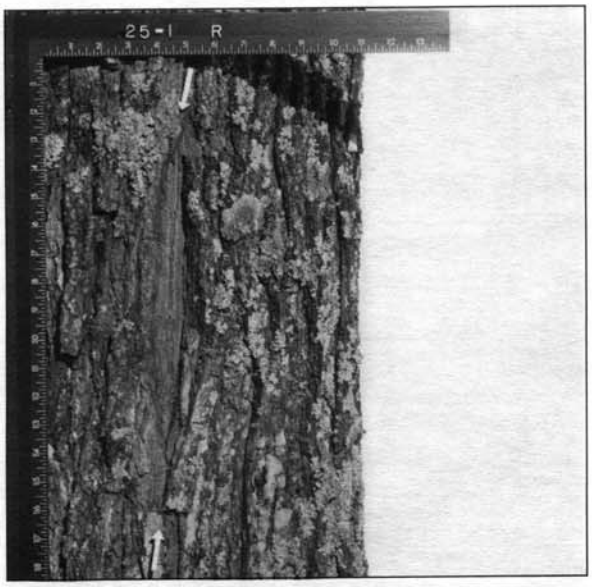


Depth below—

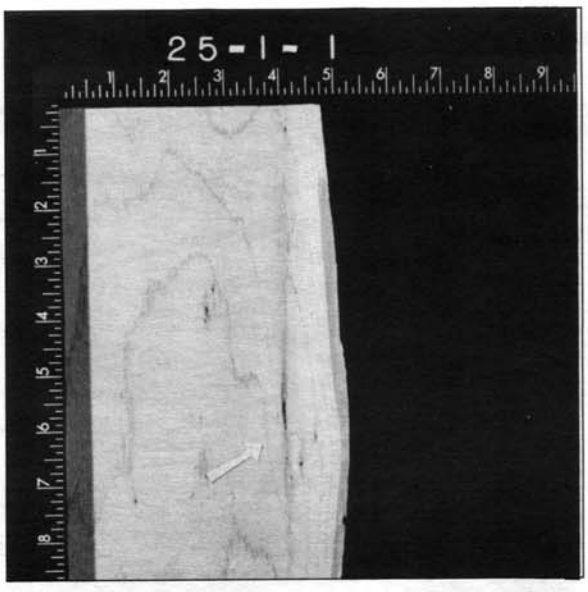
Log surface	4.1 inches
First sheet of veneer	3.6 inches
Total Veneer Thickness	4.2 inches

Figure 11.—Sound wound and associated internal defects. (Early spring felling damage)

Stereo view of defect indicator



Defect size	10 × 1 inches
Log diameter at defect (ib)	14.9 inches
Round-up thickness	0.0 inch
Core diameter	5.9 inches
Defect distance above stump	14.0 feet



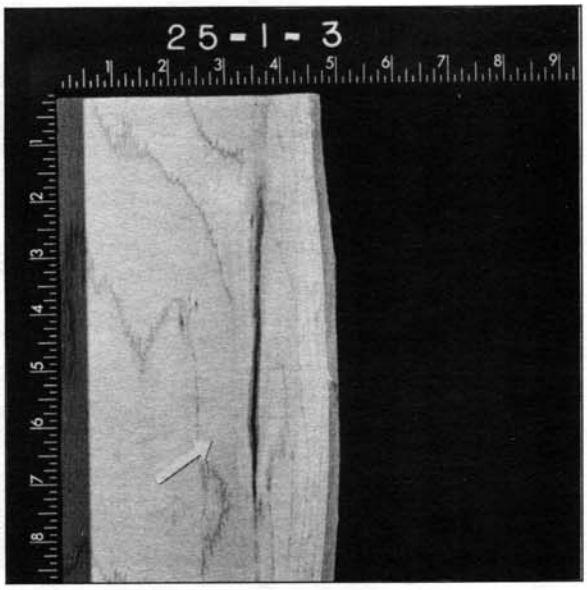
Depth below—

Log surface	0.4 inch
First sheet of veneer	0.4 inch

Figure 11 (Continued)

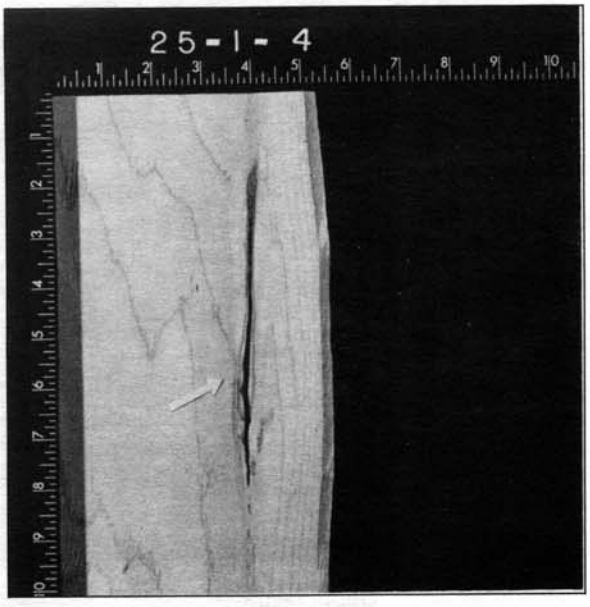
Depth below—

Log surface	0.5 inch
First sheet of veneer	0.5 inch



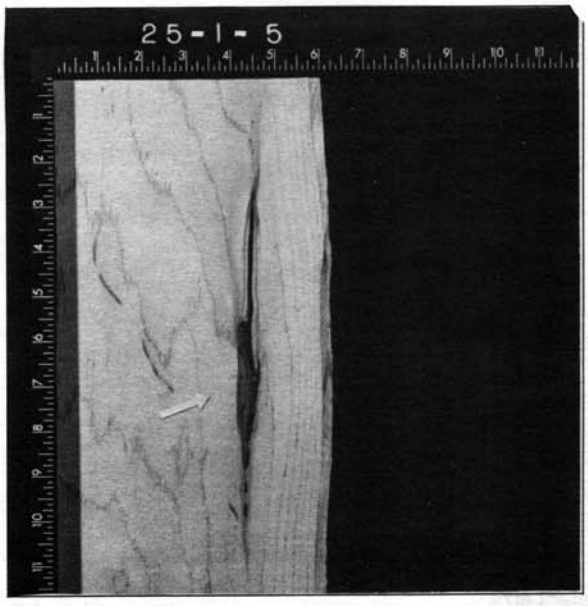
Depth below—

Log surface	0.6 inch
First sheet of veneer	0.6 inch



Depth below—

Log surface	0.7 inch
First sheet of veneer	0.7 inch



Depth below—

Log surface	0.8 inch
First sheet of veneer	0.8 inch

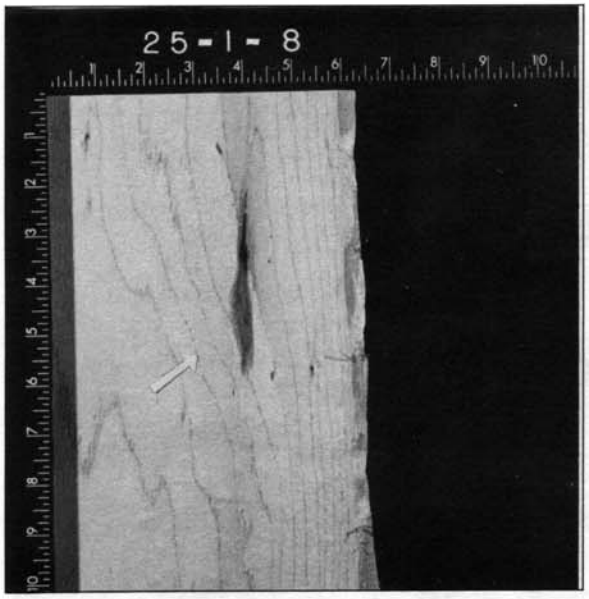
Figure 11 (Continued)

Depth below—

Log surface	0.9 inch
First sheet of veneer	0.9 inch

Depth below—

Log surface	1.0 inch
First sheet of veneer	1.0 inch

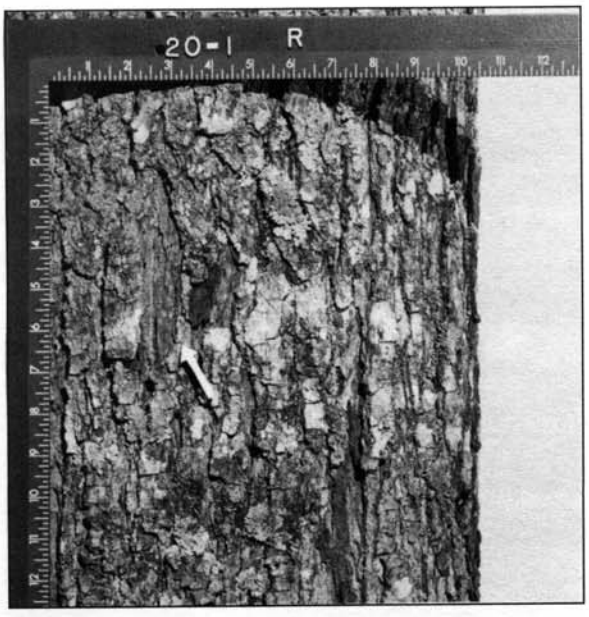


Depth below—

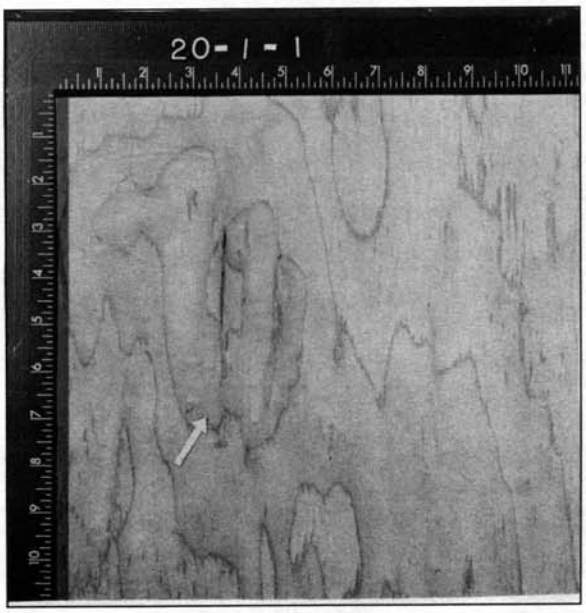
Log surface	1.1 inches
First sheet of veneer	1.1 inches
Total Veneer Thickness	4.4 inches

Figure 12.—Sound wound and associated internal defects. (Early spring felling damage)

Stereo view of defect indicator



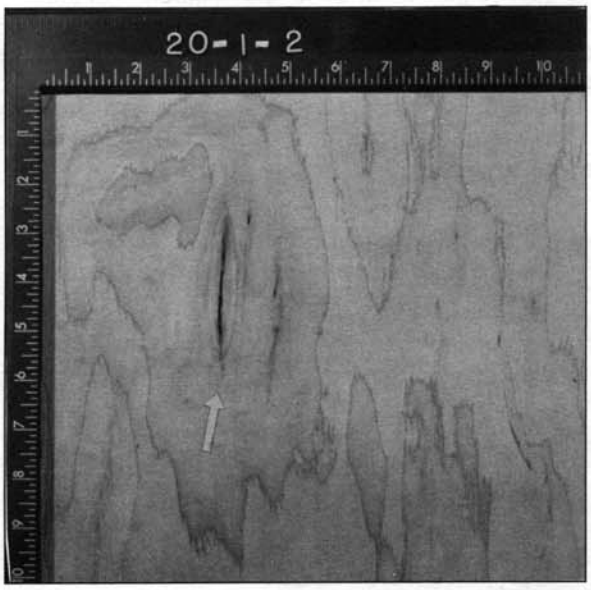
Defect size	5 × 1 inches
Log diameter at defect (ib)	14.2 inches
Round-up thickness	0.0 inch
Core diameter	5.7 inches
Defect distance above stump	7.5 feet



Depth below—

Log surface	0.5 inch
First sheet of veneer	0.5 inch

Figure 12 (Continued)

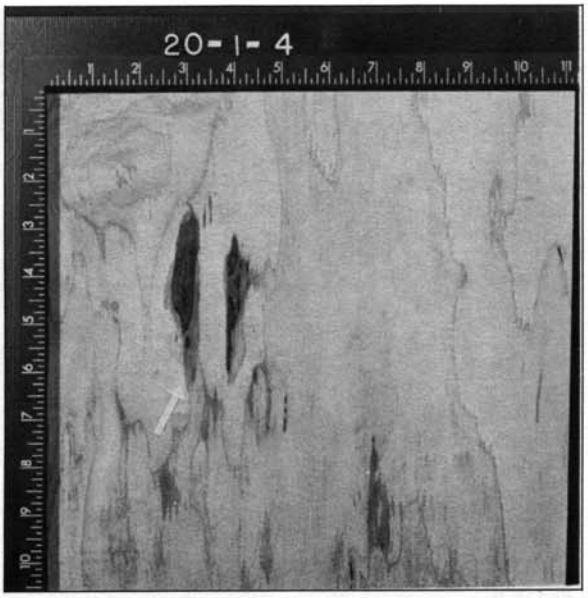


Depth below—

Log surface	0.7 inch
First sheet of veneer	0.7 inch

Depth below—

Log surface	0.9 inch
First sheet of veneer	0.9 inch



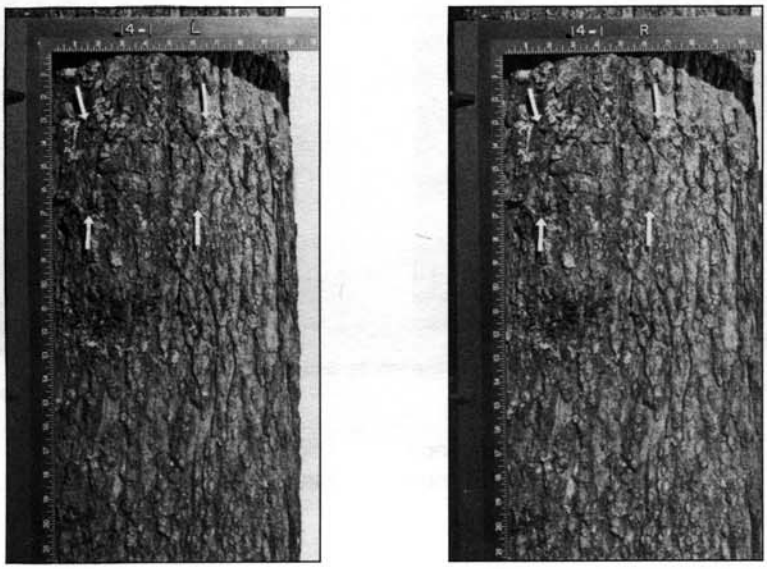
Depth below—

Log surface	1.0 inches
First sheet of veneer	1.0 inches
Total Veneer Thickness	4.0 inches

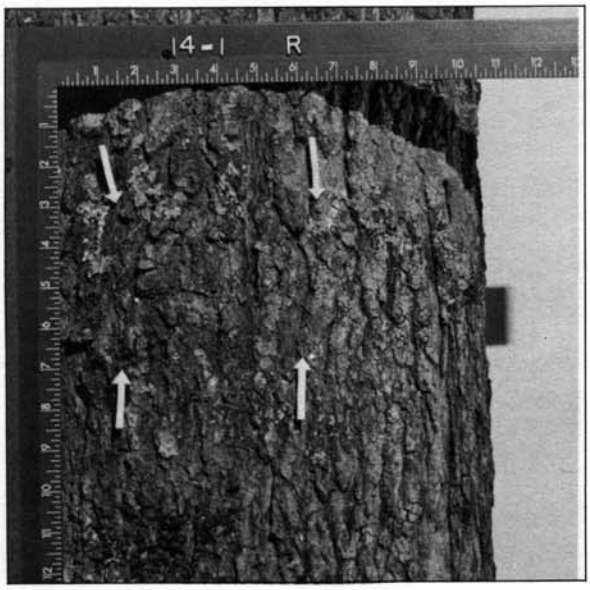
Surface Rise

A surface rise is the lowest category (least damaging) of bumps (Rast et al. 1973). It is not considered a degrader since the defect beneath it is deep enough to be disregarded in log and tree grading. The surface rise shown in Figure 13 meets both criteria for not being considered a defect—the ratio of height to length is less than 1:12 and the defect is contained within the inner quality zone and the heart center. More than 90 percent of all bumps (regardless of the category) are caused by overgrown knots or suppressed bud clusters. The underlying defect in Figure 13 is a suppressed bud cluster.

Figure 13.—Surface rise and associated internal defects.



Stereo view of defect indicator

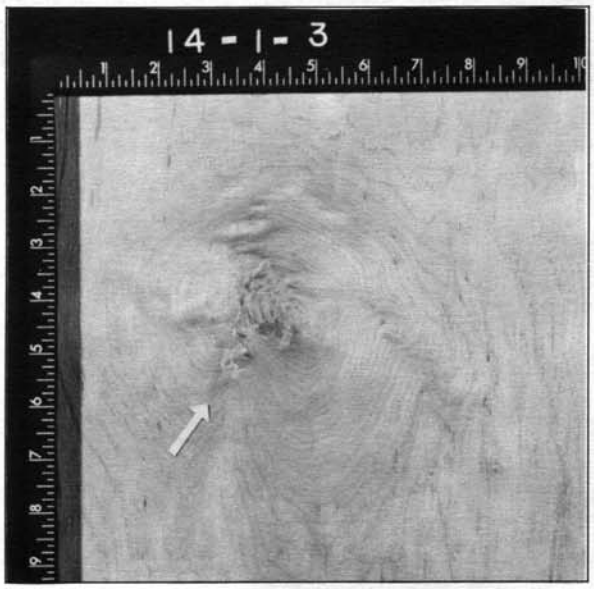


Defect size	4 × 8 × 0.1 inches
Log diameter at defect (ib)	13.0 inches
Round-up thickness	0.1 inch
Core diameter	5.8 inches
Defect distance above stump	8.5 feet

Depth below—

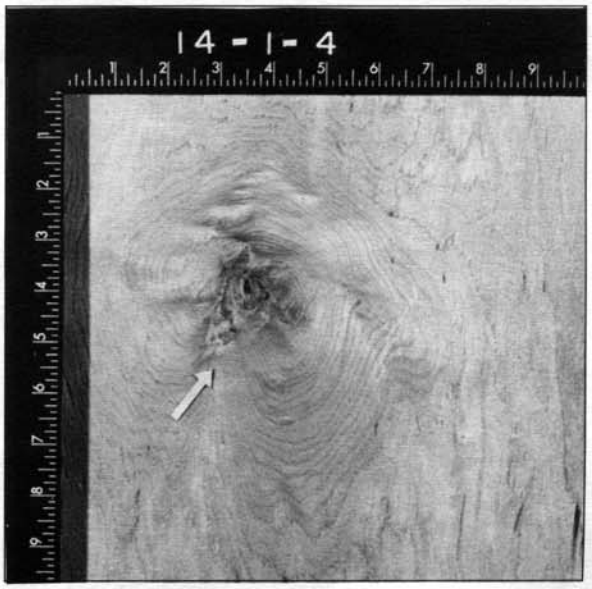
Log surface	2.1 inches
First sheet of veneer	2.0 inches

Figure 13 (Continued)



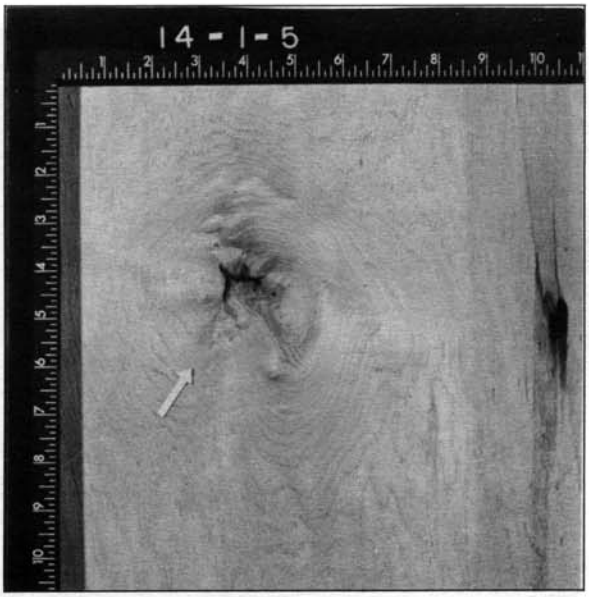
Depth below—

Log surface	3.1 inches
First sheet of veneer	3.0 inches



Depth below—

Log surface	3.3 inches
First sheet of veneer	3.2 inches



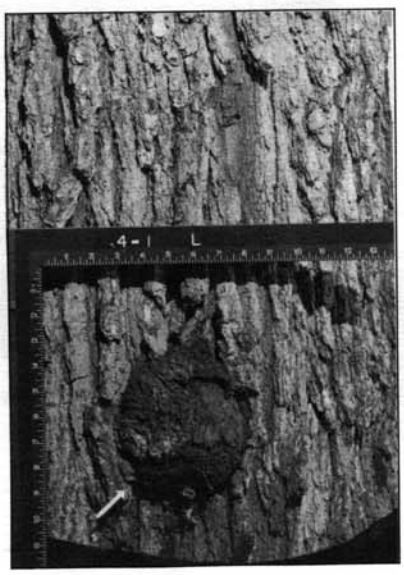
Depth below—

Log surface	3.6 inches
First sheet of veneer	3.5 inches
Total Veneer Thickness	3.5 inches

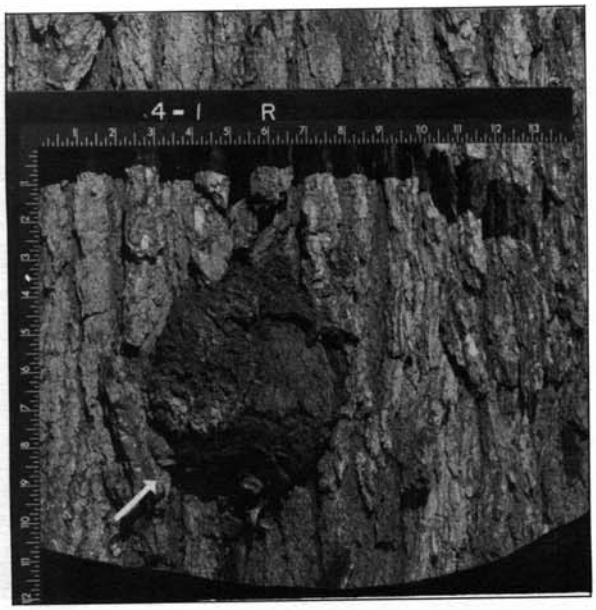
Burl

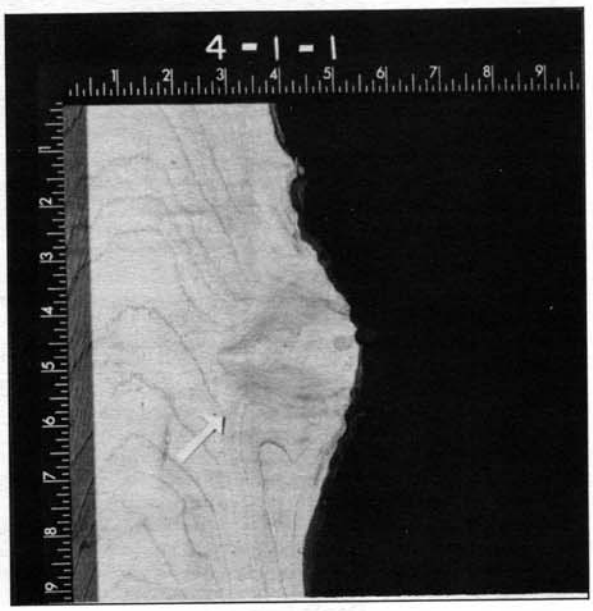
Burls are accompanied by distorted grain, and often they contain ingrown bark, rot, stain, and occasionally epicormic knots. Burls are definitely a defect, but there is a specialty market for large burls for the production of such items as bowls and other novelties. Figure 14 shows a burl on sugar maple that contains some stain and rot, but other than that, there is just a small area of distorted grain going all the way back to the heart center. Most burls are usually very low to the ground and often a high stump is cut to eliminate it from the sawlog. This burl was only 1.5 feet above the stump.

Figure 14.—Burl and associated internal defects.



Stereo view of defect indicator



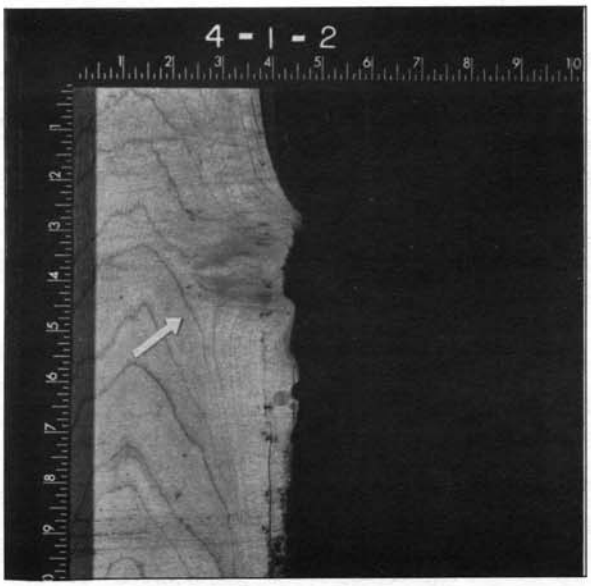


Defect size	5 × 5 × 3 inches
Log diameter at defect (ib)	19.9 inches
Round-up thickness	0.0 inch
Core diameter	7.8 inches
Defect distance above stump	1.5 feet

Depth below—

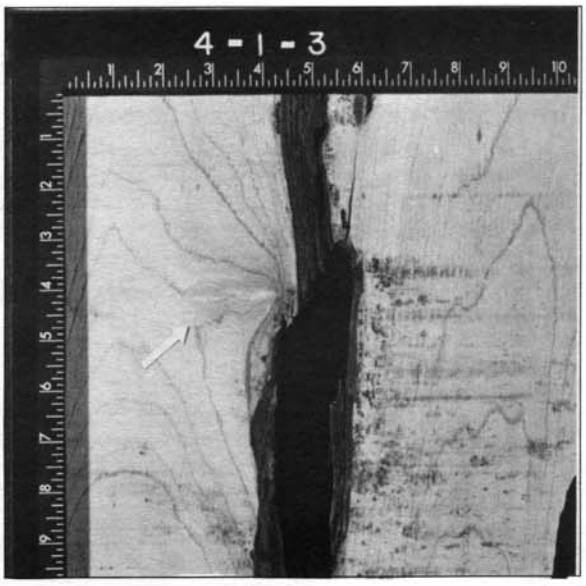
Log surface	0.1 inch
First sheet of veneer	0.1 inch

Figure 14 (Continued)



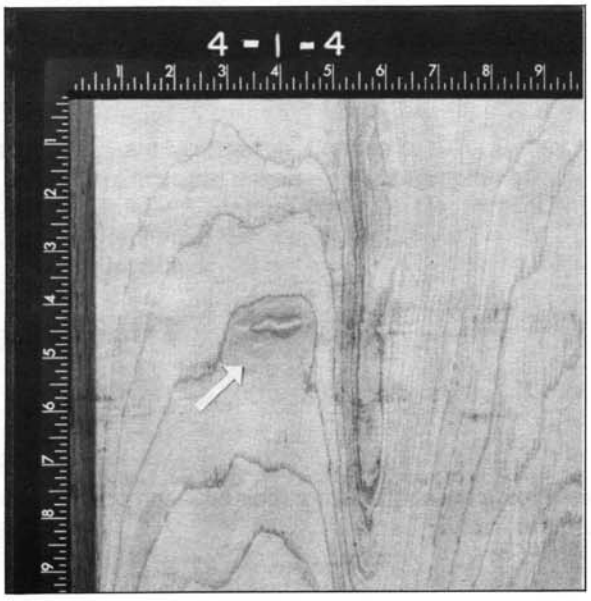
Depth below—

Log surface	0.5 inch
First sheet of veneer	0.5 inch



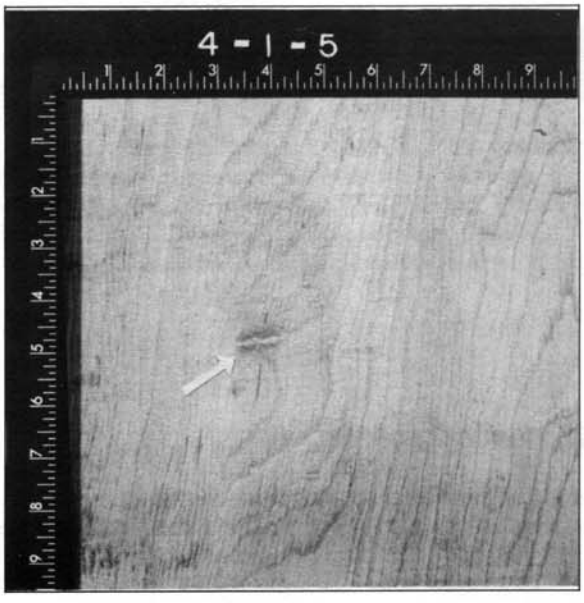
Depth below—

Log surface	1.5 inches
First sheet of veneer	1.5 inches



Depth below—

Log surface	2.5 inches
First sheet of veneer	2.5 inches



Depth below—

Log surface	4.0 inches
First sheet of veneer	4.0 inches

Figure 14 (Continued)

Depth below—

Log surface	6.0 inches
First sheet of veneer	6.0 inches
Total Veneer Thickness	7.0 inches

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To properly classify or grade logs or trees, one must be able to correctly identify defect indicators and assess the effect of the underlying defect on possible end products. This guide assists the individual in identifying the surface defect indicator and shows the progressive stages of the defect throughout its development for sugar maple. Eleven types of external defect indicators and associated defects that are particularly difficult to evaluate are illustrated and described.

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Keywords: Defect identification; photo guide; sugar maple; quality assessment

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