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Photographic Guide of Selected External Defect Indicators and Associated Internal Defects in Yellow Birch

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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 yellow birch. 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 yellow birch is the seventh 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 yellow-poplar (Rast et al. 1990) and white oak (Rast et al. 1989) studies, bolts were sliced and photographs of 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

Twelve yellow birch trees on the Florence Ranger District of the Nicolet National Forest in northeastern Wisconsin were selected, felled, and bucked into twenty-three 4-foot bolts containing the defects selected 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 processed and the prints 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 of 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

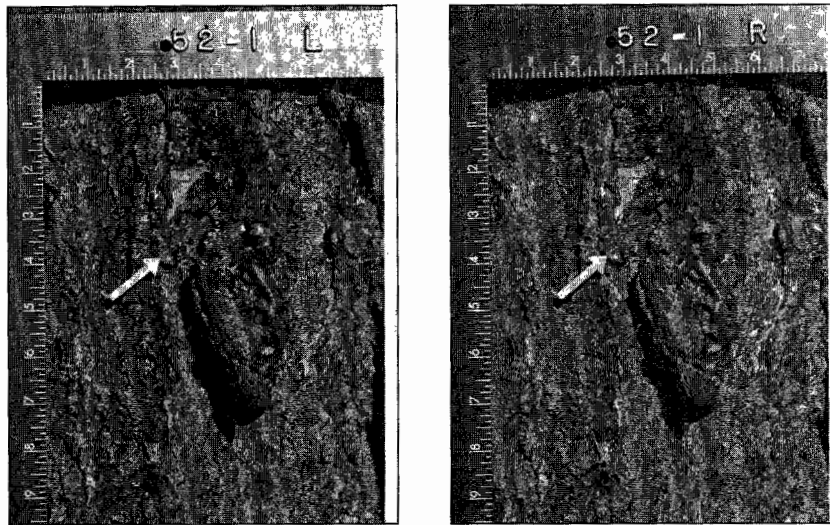
The defect indicators reported in this publication are: suppressed bud; adventitious bud; suppressed bud cluster; open bird peck; light, medium, and heavy distortions; new and old sound wounds; seam; and gunshot wound. We believe that these indicators often are difficult to identify and evaluate in terms of their effect on end-product quality. Graders normally have little difficulty recognizing and evaluating 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.

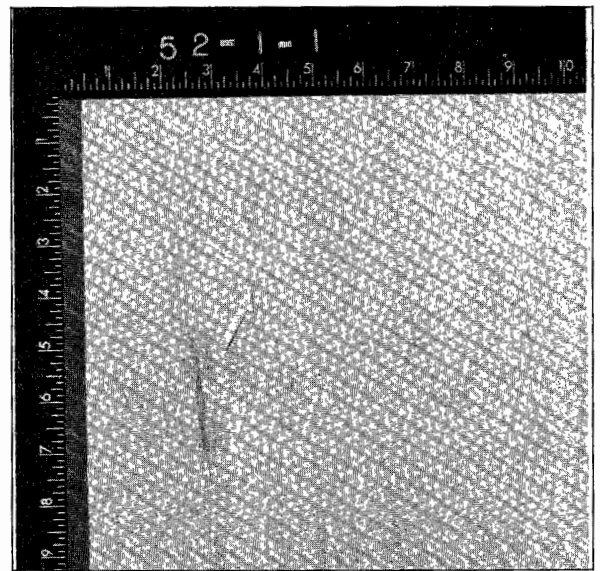
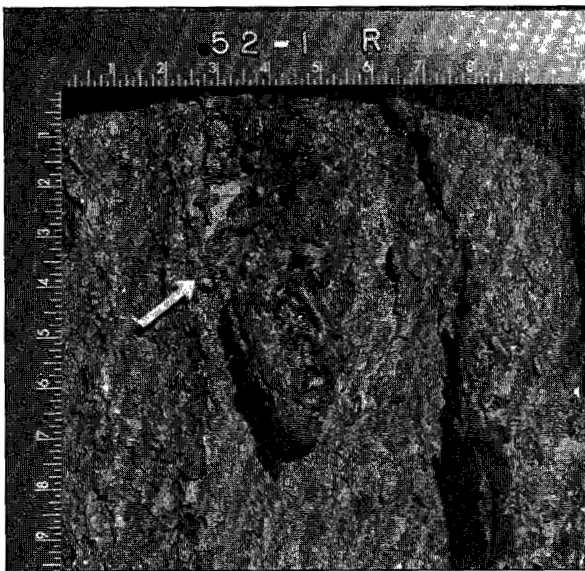
Suppressed and Adventitious Buds

Epicormic branches develop from two types of buds: suppressed or dormant buds and adventitious buds (Kormanik and Brown 1969 and Shigo 1986). **Suppressed buds** (Fig. 1) 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, but the bud trace usually continues to form in the cambial zone even after the epicormic limb dies and eventually drops off, sometimes forming another epicormic limb that also dies and drops off. Or the suppressed bud may cease all activity in the cambial zone following its occurrence, showing no evidence of the bud trace. By contrast, an **adventitious bud** (Fig. 2) forms 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

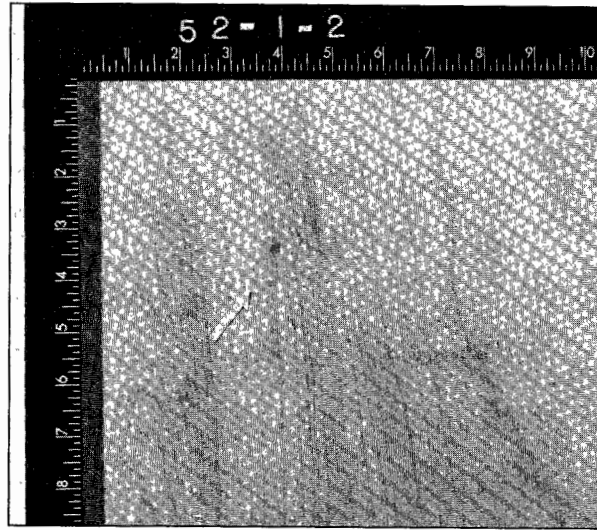


Defect size	1/2 x 1/2 inches
Log diameter at defect (lb)	16.4 inches
Round-up thickness	0.0 inch
Core diameter	6.8 inches
Defect distance above stump	8.5 feet

Depth below—

Log surface	0.0 inch
First sheet of veneer	0.0 inch

Figure 1 (Continued)



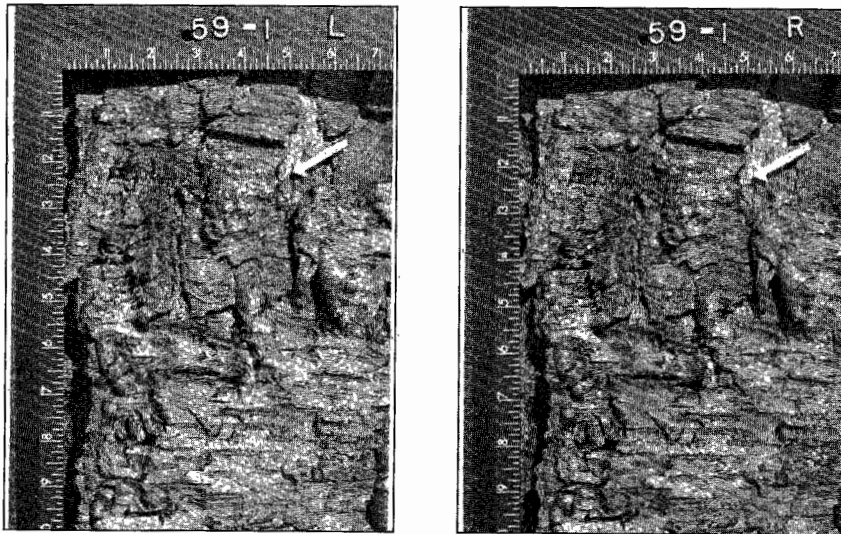
Depth below—

Log surface 4.7 inches

First sheet of veneer 4.7 inches

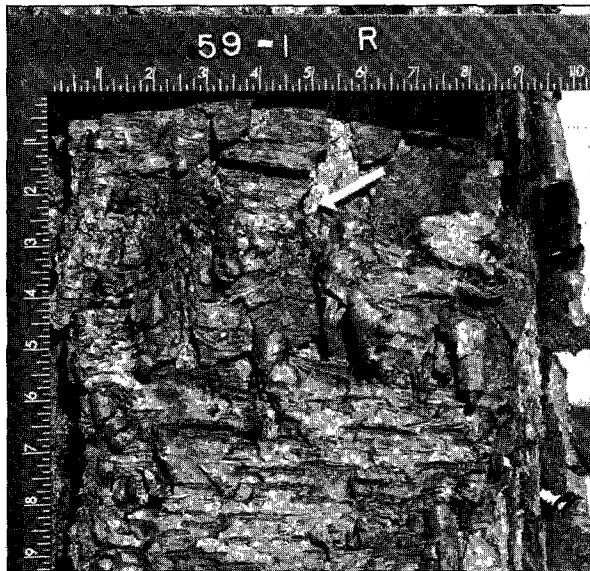
Total Veneer Thickness 2.8 inches

Figure 2.—Adventitious bud and associated internal defects.

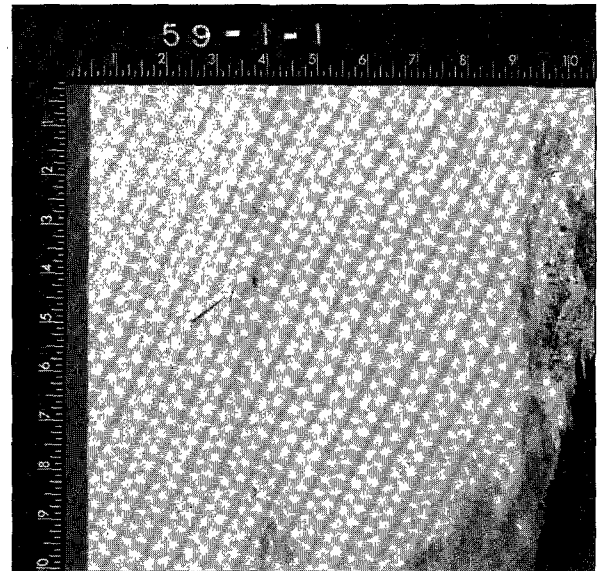


Stereo view of defect indicator

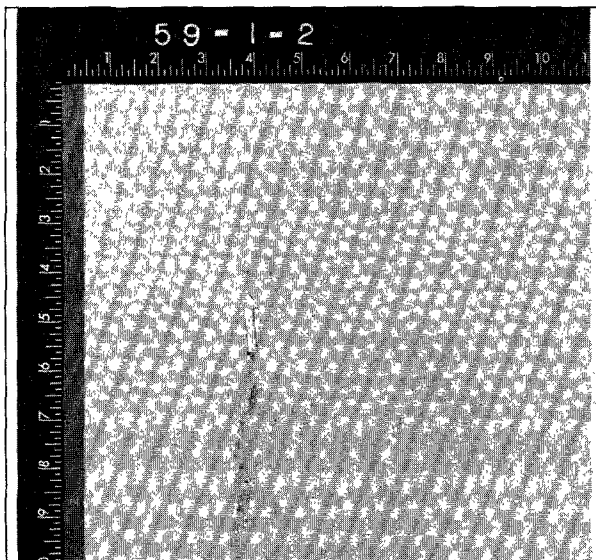
Figure 2 (Continued)



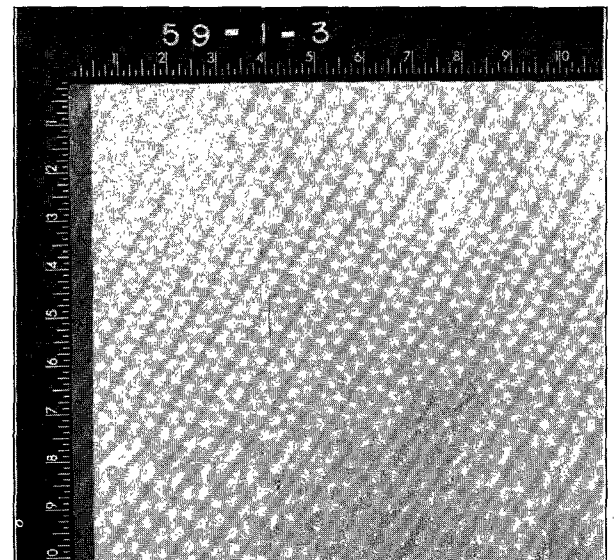
Defect size	1 x 1 inches
Log diameter at defect (ib)	12.0 inches
Round-up thickness	0.5 inch
Core diameter	5.6 inches
Defect distance above stump	19.0 feet



Depth below—	
Log surface	0.0 inch
First sheet of veneer	0.5 inch



Depth below—	
Log surface	0.5 inches
First sheet of veneer	1.0 inches



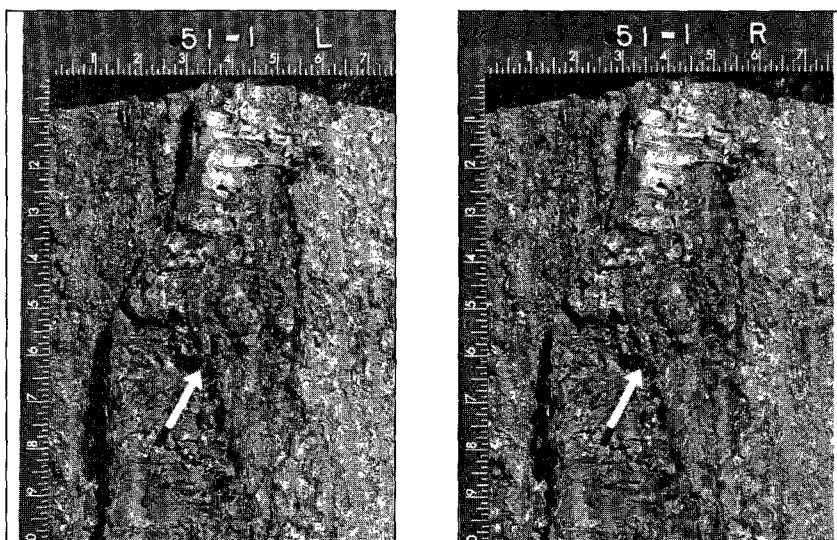
Depth below—	
Log surface	0.8 inch
First sheet of veneer	1.3 inches
Total Veneer Thickness	2.8 inches

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 2 by 2 inches or less in size. Usually, there is evidence of concentric rings around the defect indicator. Figure 3 does not show the presence of the concentric rings around the defect indicator, but this is common in thin-barked trees such as yellow birch. The

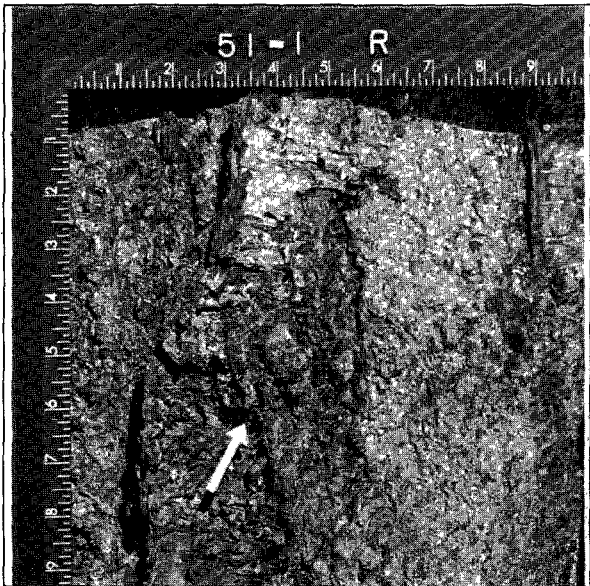
small protuberance associated with a single bud is much larger with this suppressed bud cluster and there is evidence of several individual buds. Also, two adventitious knots are clearly visible in the first defect photo (4.3 inches below log surface) and several others can be detected in the third defect photo (5.1 inches below log surface).

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

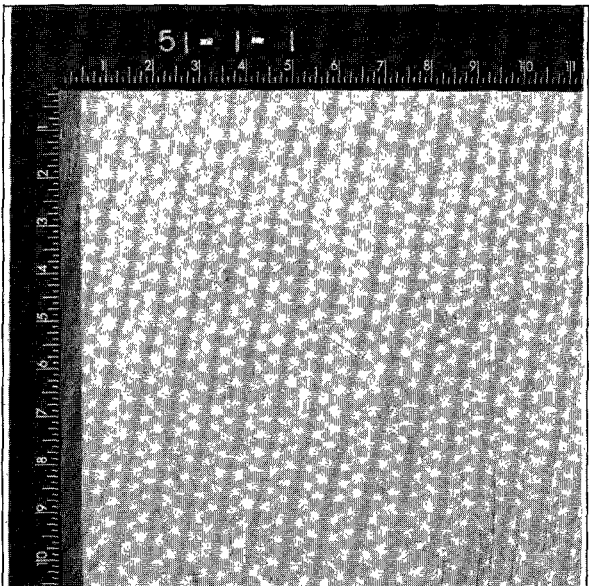


Stereo view of defect indicator

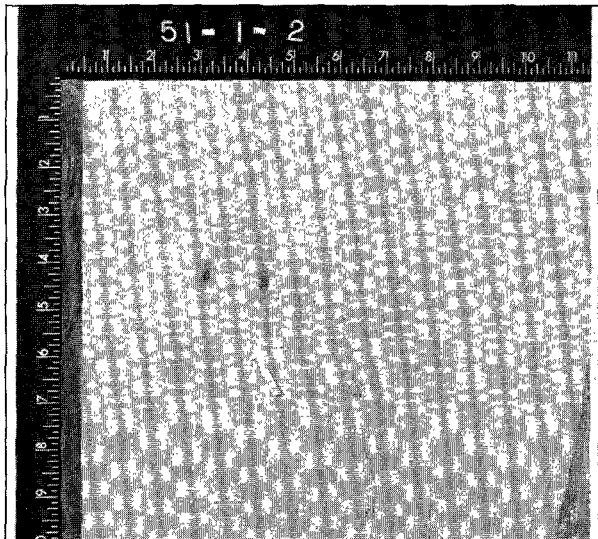
Figure 3 (Continued)



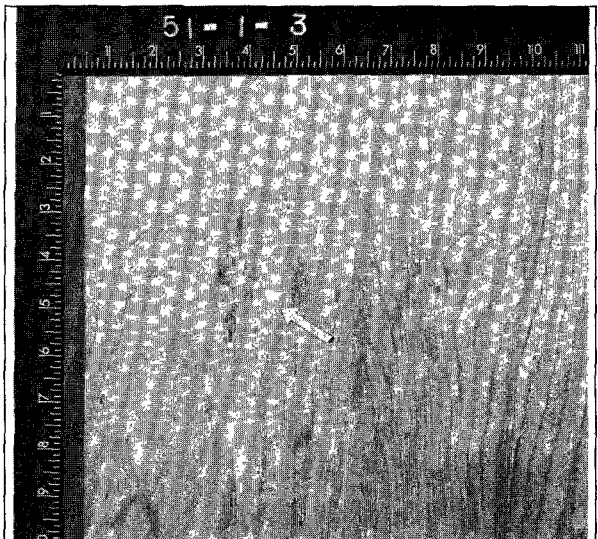
Defect size 2 x 2 inches
Log diameter at defect (ib) 18.0 inches
Round-up thickness 0.0 inch
Core diameter 5.9 inches
Defect distance above stump 5.0 feet



Depth below—
Log surface 4.3 inches
First sheet of veneer 4.3 inches

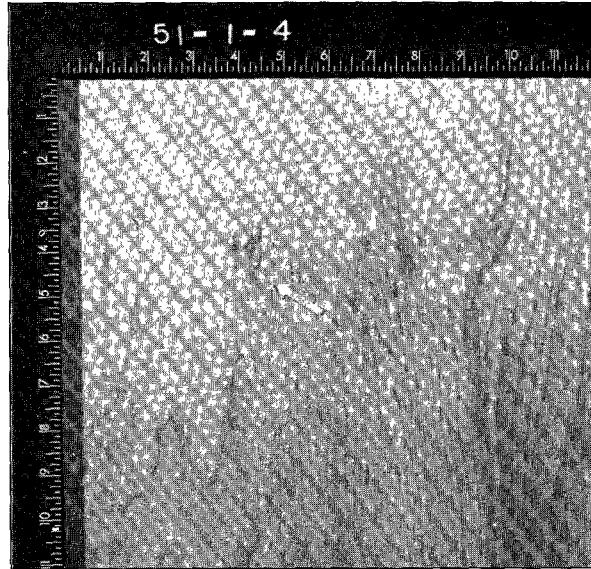


Depth below—
Log surface 4.8 inches
First sheet of veneer 4.8 inches



Depth below—
Log surface 5.1 inches
First sheet of veneer 5.1 inches

Figure 3 (Continued)



Depth below—

Log surface	5.3 inches
First sheet of veneer	5.3 inches
Total Veneer Thickness	6.5 inches

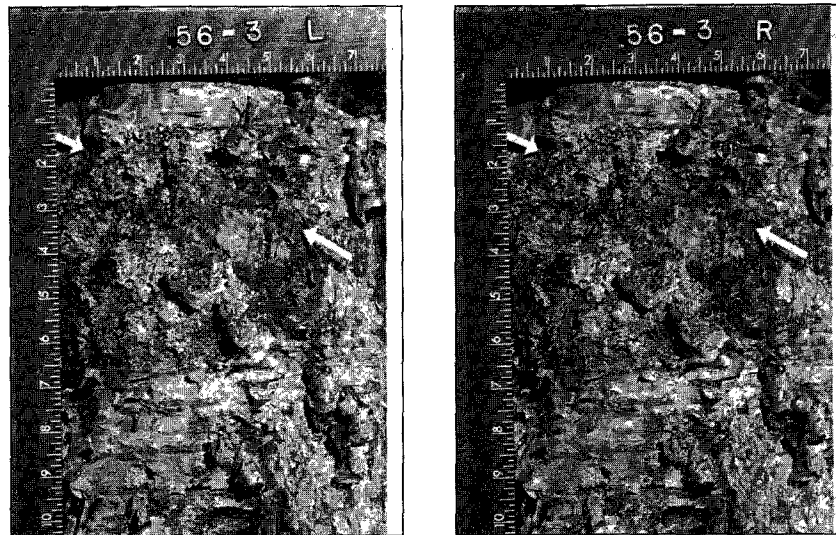
Bird Peck

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 (callus material present), 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 of the log (debarking, slabbing, or round-up).

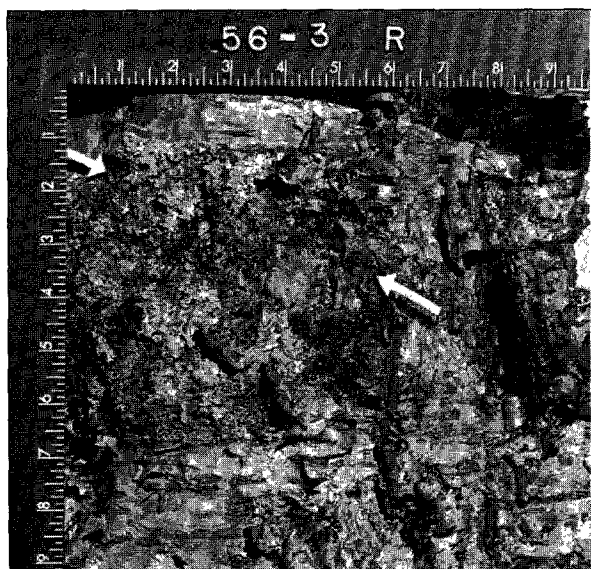
Figure 4 shows **open bird peck** that is not occluded and, therefore, can be disregarded. No photos of the veneer were taken since there were no defects in the underlying wood.

In the area where our study trees were selected, we found only one tree with bird peck (the open bird peck is shown in Figure 4). But this does not mean that bird peck is not a problem in yellow birch; in fact, it can be a major problem. For evidence of bird peck in the underlying wood, see other photo guides or publications listed in the back of this publication. Severe bird peck in any species can lead to a separation of the wood along the rings.

Figure 4.—Open bird peck.



Stereo view of defect indicator



Defect size	1 × 6 inches
Log diameter at defect (ib)	13.0 inches
Round-up thickness	0.7 inch
Core diameter	5.6 inches
Defect distance above stump	24.5 feet

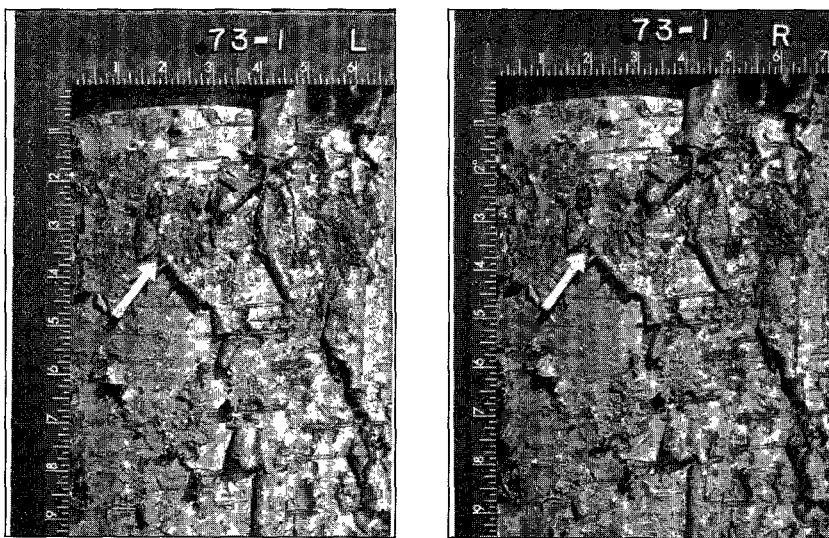
Bark Distortions

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. 5) 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. 6) show more of the concentric circles, but they are broken in several areas by the regular bark pattern running lengthwise through the defect indicator. Also, there can be present 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. 7) are

identified by the characteristic pattern of concentric circles encompassing the defect indicator and “pucker-like” appearance of the center.

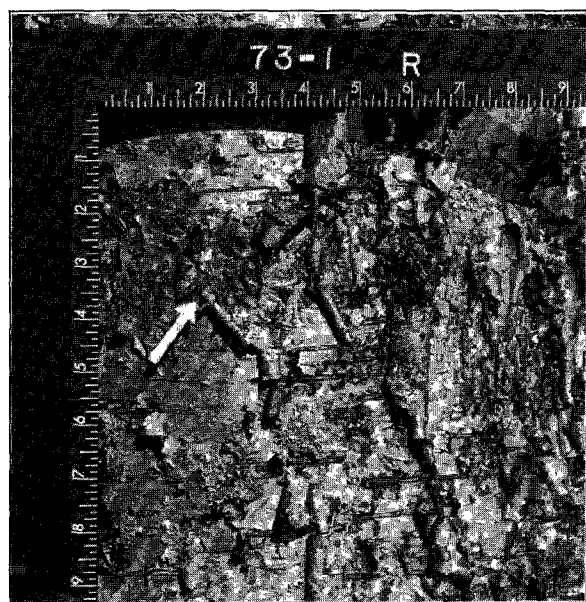
All bark distortions result in some product degrade, but the amount of degrade decreases as the depth to the initial defect below the log surface increases. Light bark distortions, because of their greater depth below the log surface, are not considered defects in grading factory lumber logs, but medium 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 5.—Light bark distortion and associated internal defects.

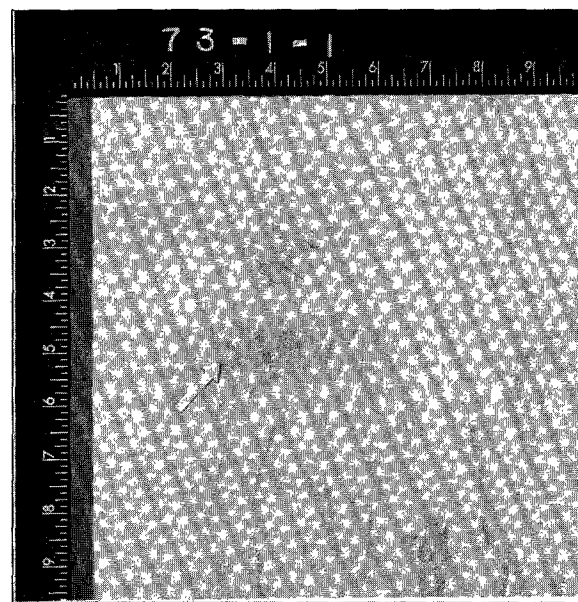


Stereo view of defect indicator

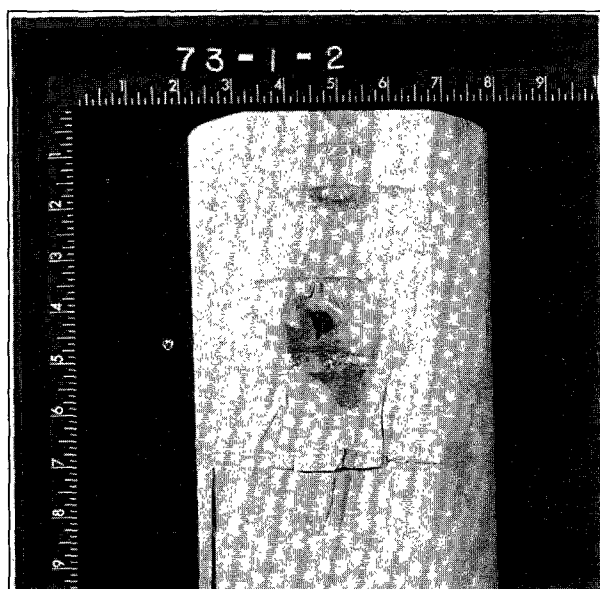
Figure 5 (Continued)



Defect size	1 x 1 inches
Log diameter at defect (ib)	12.5 inches
Round-up thickness	0.3 inch
Core diameter	6.0 inches
Defect distance above stump	20.0 feet

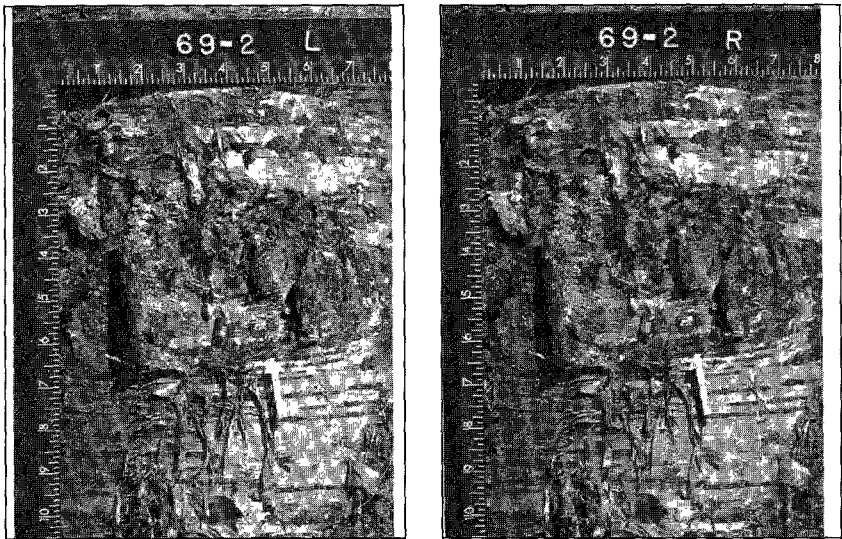


Depth below—	
Log surface	3.0 inches
First sheet of veneer	3.3 inches

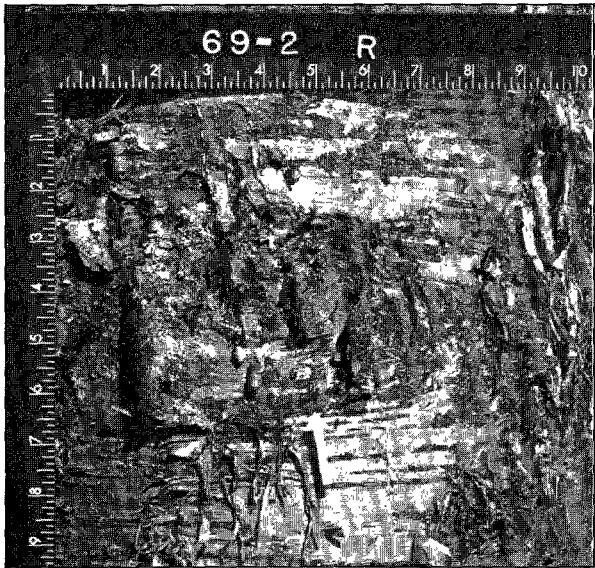


Depth below—	
Log surface	3.5 inches
First sheet of veneer	3.8 inches
Total Veneer Thickness	3.0 inches
(photograph taken 1/2 inch inside of core)	

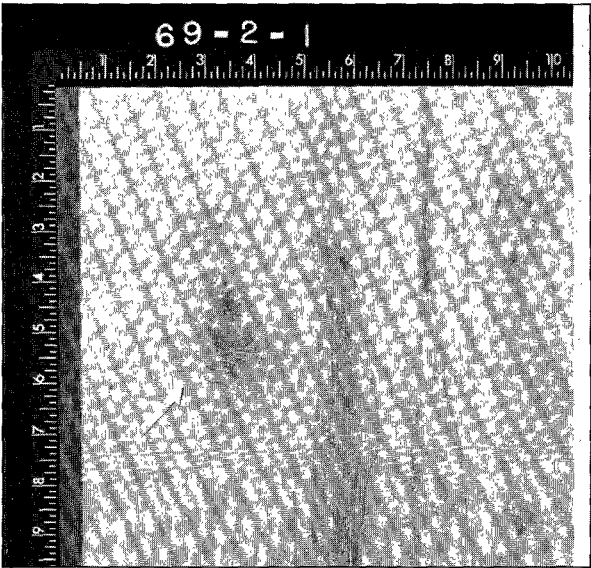
Figure 6.—Medium bark distortion and associated internal defects.



Stereo view of defect indicator

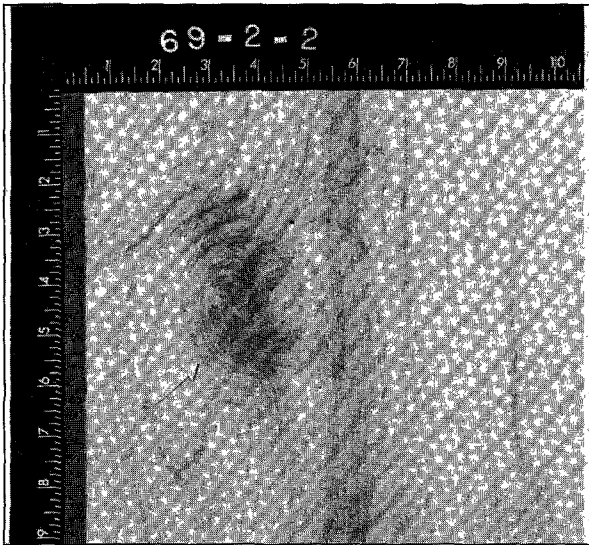


Defect size 3 x 3 inches
Log diameter at defect (ib) 12.8 inches
Round-up thickness 0.5 inch
Core diameter 5.7 inches
Defect distance above stump 21.5 feet



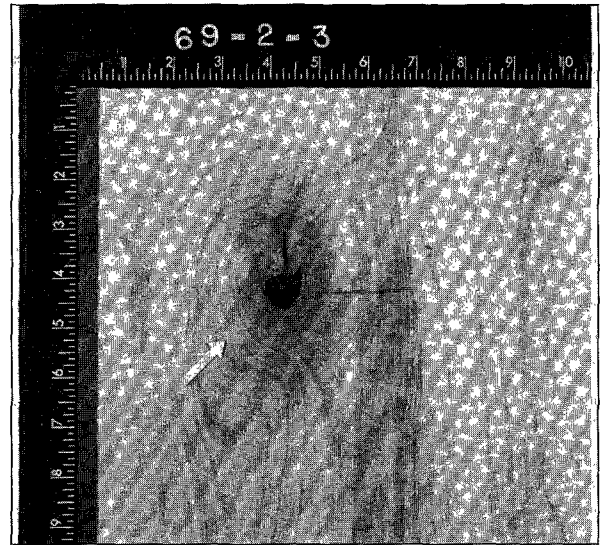
Depth below—
Log surface 2.1 inches
First sheet of veneer 2.6 inches

Figure 6 (Continued)



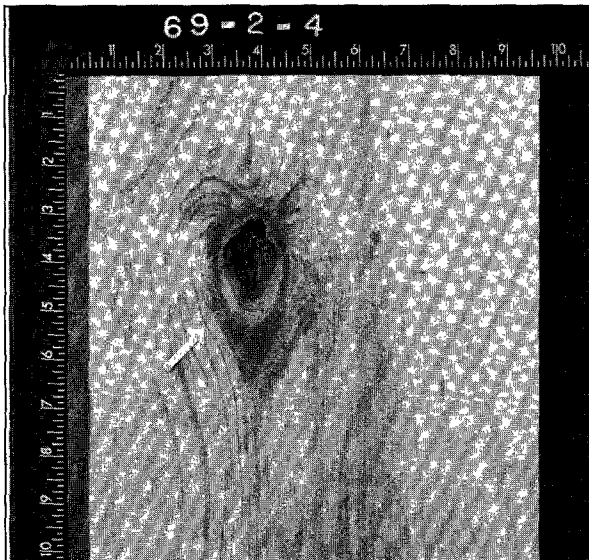
Depth below—

Log surface 2.3 inches
 First sheet of veneer 2.8 inches



Depth below—

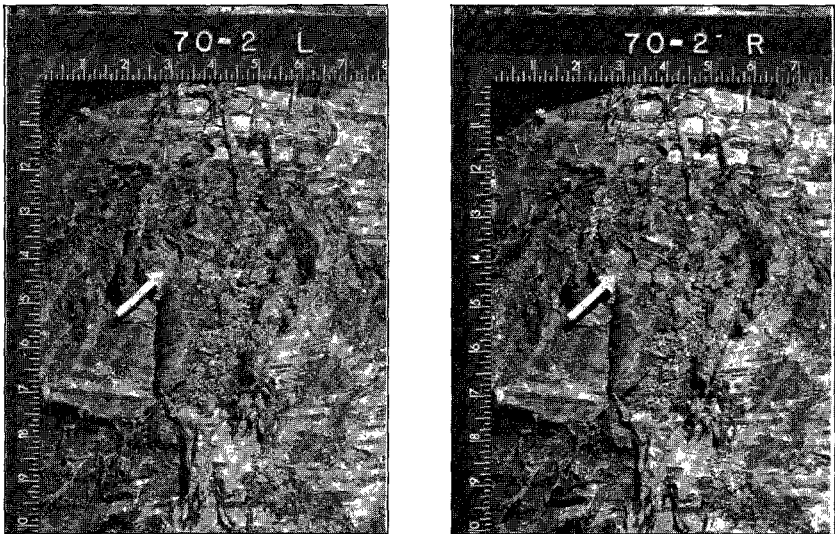
Log surface 2.5 inches
 First sheet of veneer 3.0 inches



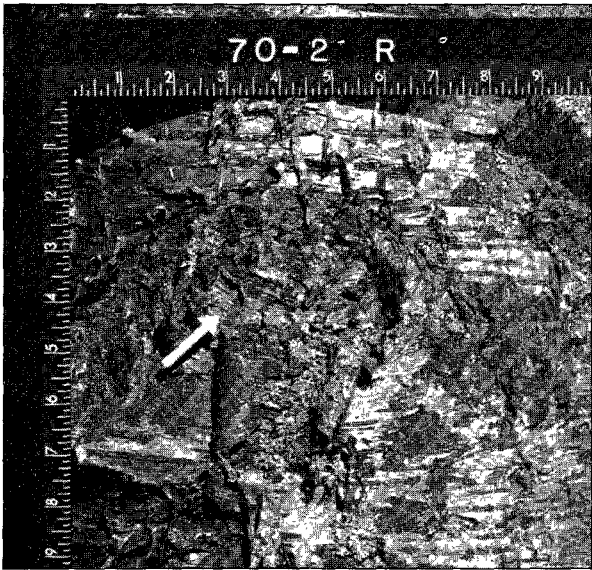
Depth below—

Log surface 2.9 inches
 First sheet of veneer 3.4 inches
 Total Veneer Thickness 2.9 inches

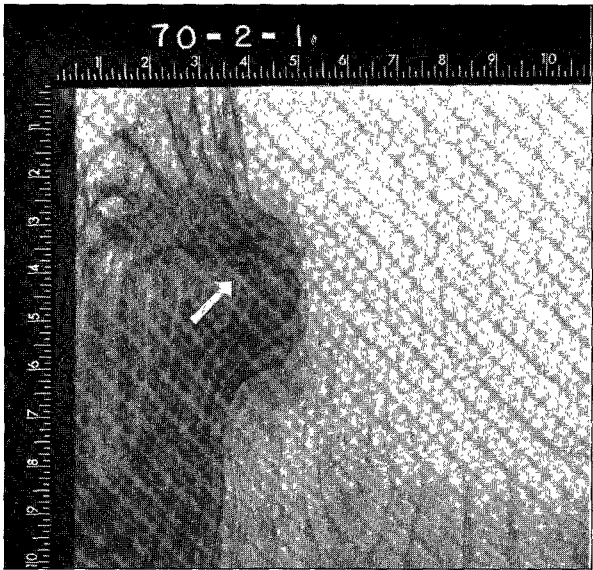
Figure 7.—Heavy bark distortion and associated internal defects.



Stereo view of defect indicator

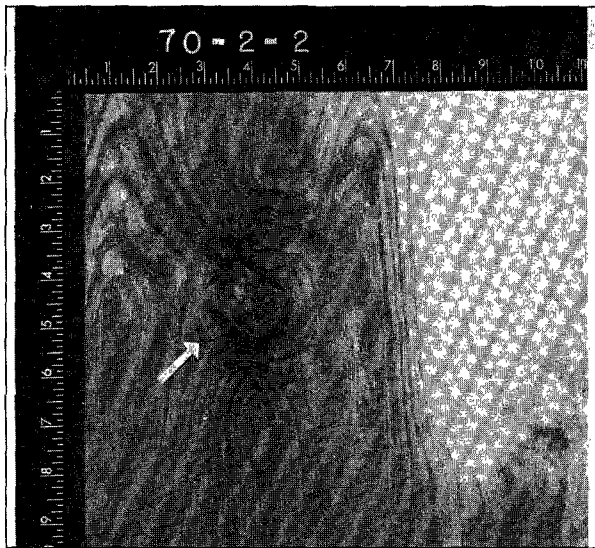


Defect size 2 x 2 inches
Log diameter at defect (ib) 12.0 inches
Round-up thickness 0.7 inch
Core diameter 5.7 inches
Defect distance above stump 27.0 feet



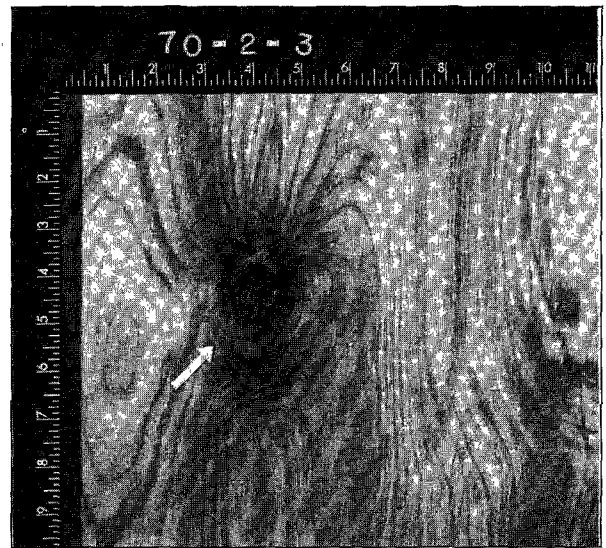
Depth below—
Log surface 0.5 inch
First sheet of veneer 1.2 inches

Figure 7 (Continued)



Depth below—

Log surface	2.0 inches
First sheet of veneer	2.7 inches



Depth below—

Log surface	2.5 inches
First sheet of veneer	3.2 inches
Total Veneer Thickness	2.8 inches

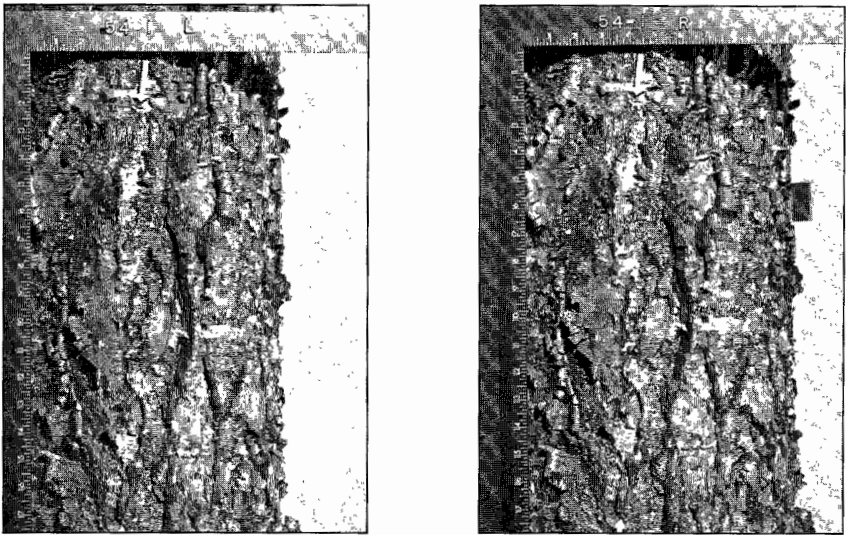
Sound Wounds

Wounds can originate from a wide range of causes—from an individual with a hatchet, a limb or another tree falling against the tree, or 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 graded defects depending on their age and depth. If a wound is recent 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 little degrade results. Whether a wound becomes unsound depends on the type, severity, time of year of occurrence, and tree vigor. Sound wounds are further classified as new (the defect will be removed during slabbing or round-up or can be contained within the outer quality zone) or old (the defect extends into the inner quality

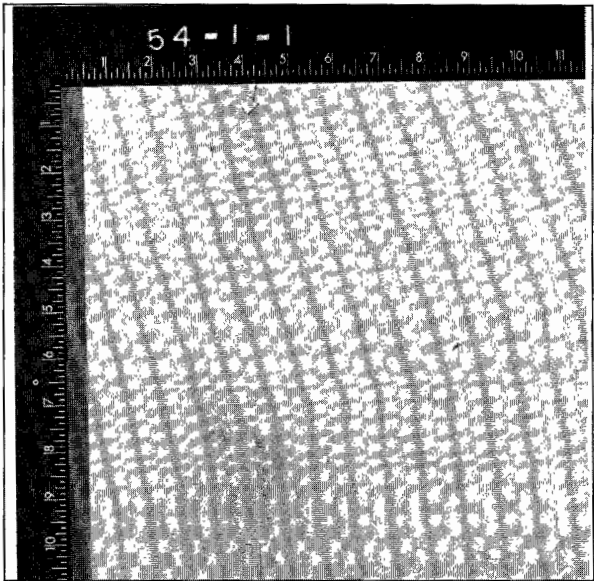
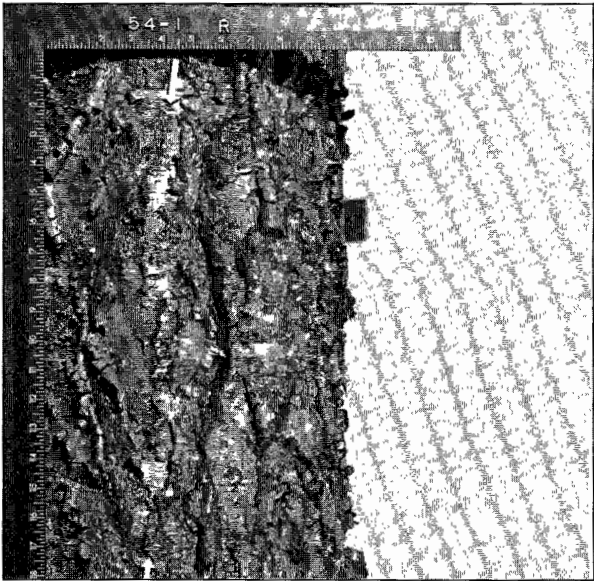
zone or the heart center).

The defect in Figure 8, a **sound wound (new)**, probably was a clean, smooth removal of the bark and some wood on a fast-growing tree because the last evidence of the defect in the veneer is only 1.7 inches below the log surface. Figure 9 shows a **sound wound (old)** in which the defect in the veneer begins 2 inches below the log surface and extends nearly to the core. 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.

Figure 8.—Sound wound (new) and associated internal defects.



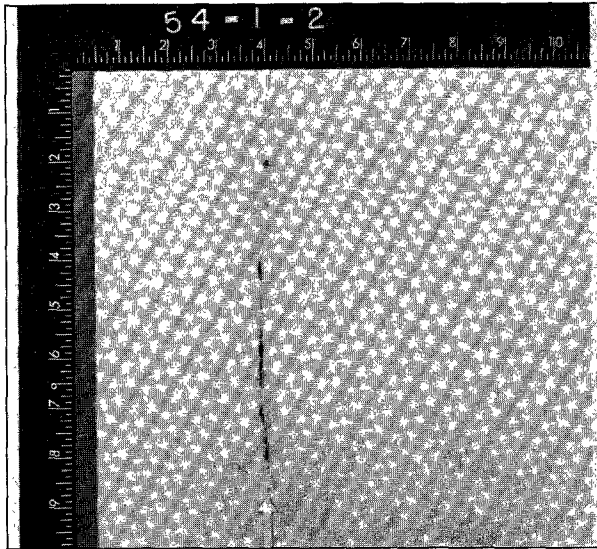
Stereo view of defect indicator



Defect size 10 x 4 inches
Log diameter at defect (ib) 13.3 inches
Round-up thickness 0.6 inch
Core diameter 5.8 inches
Defect distance above stump 6.0 feet

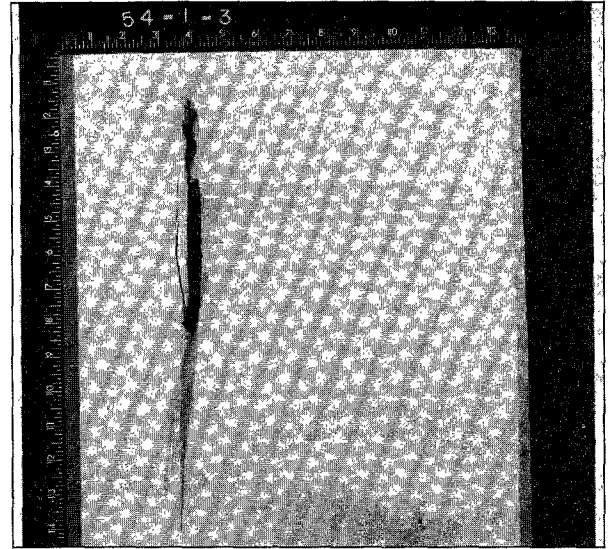
Depth below—
Log surface 0.0 inch
First sheet of veneer 0.6 inch

Figure 8 (Continued)



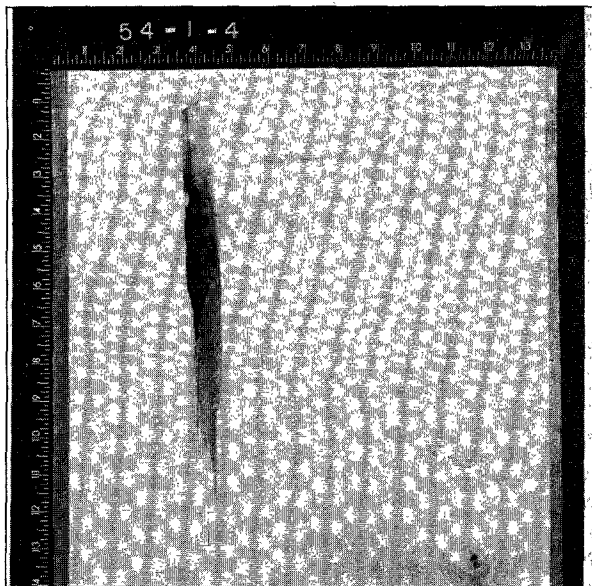
Depth below—

Log surface 0.5 inch
First sheet of veneer 1.1 inches



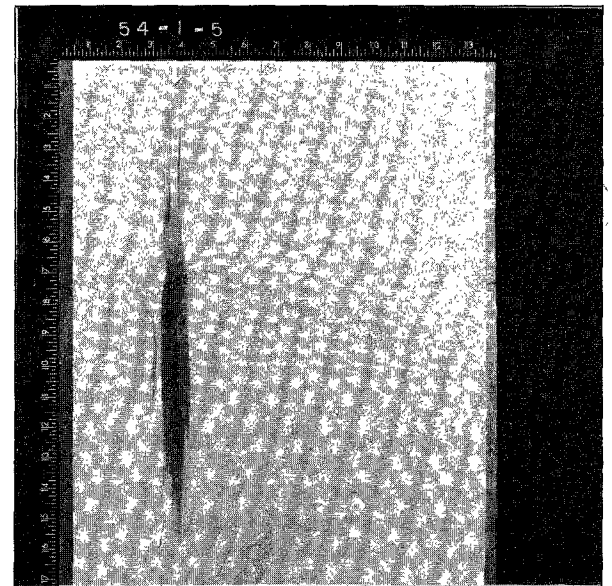
Depth below—

Log surface 1.3 inches
First sheet of veneer 1.9 inches



Depth below—

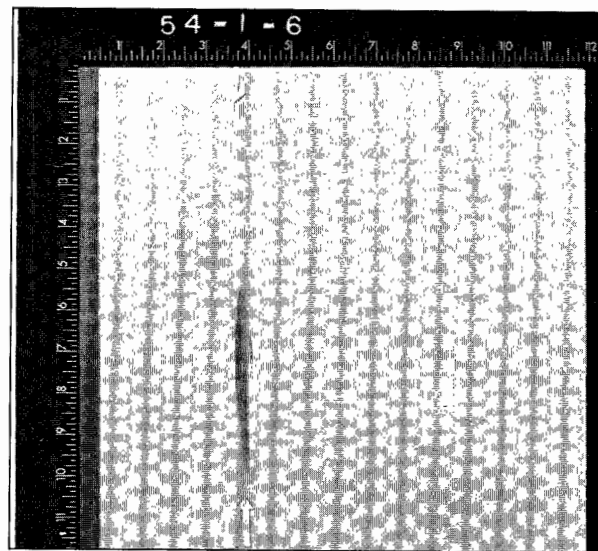
Log surface 1.4 inches
First sheet of veneer 2.0 inches



Depth below—

Log surface 1.5 inches
First sheet of veneer 2.1 inches

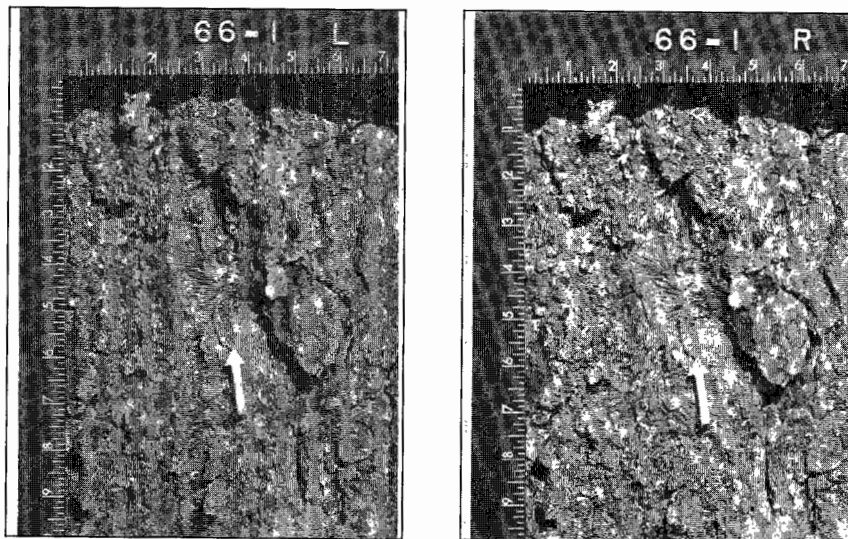
Figure 8 (Continued)



Depth below—

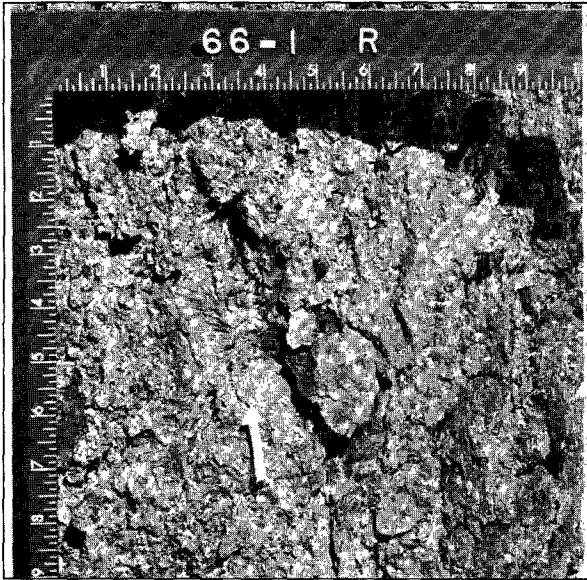
Log surface	1.7 inches
First sheet of veneer	2.3 inches
Total Veneer Thickness	3.0 inches

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

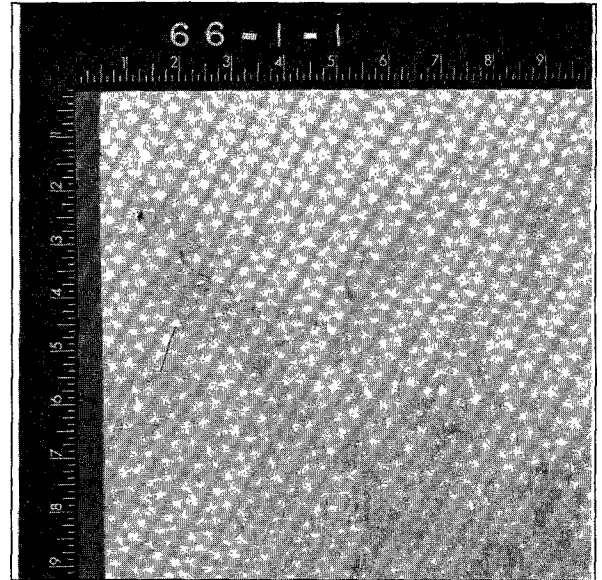


Stereo view of defect indicator

Figure 9 (Continued)

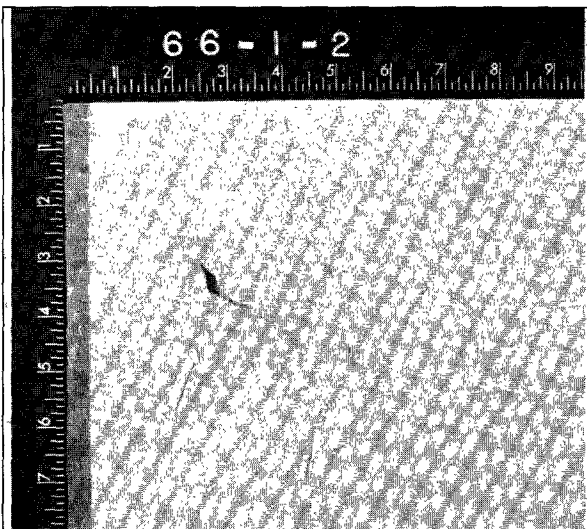


Defect size 3 x 2 inches
 Log diameter at defect (ib) 14.2 inches
 Round-up thickness 0.5 inch
 Core diameter 6.2 inches
 Defect distance above stump 10.0 feet



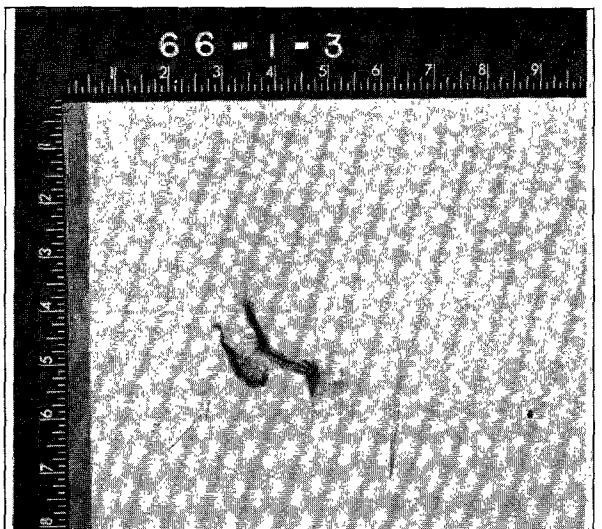
Depth below—

Log surface 2.0 inches
 First sheet of veneer 2.5 inches



Depth below—

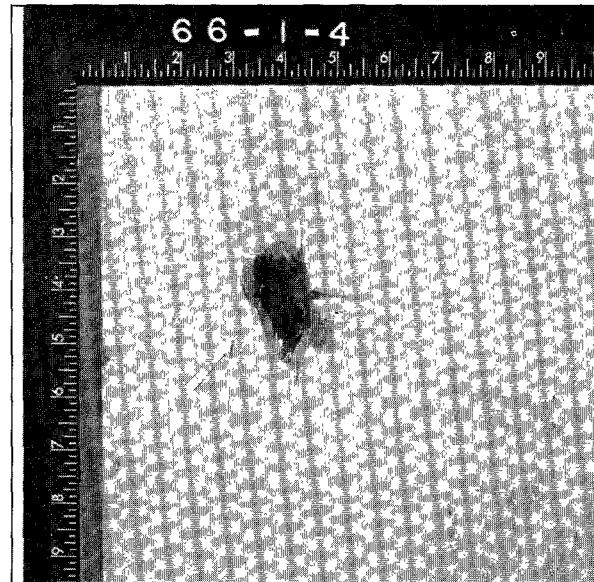
Log surface 2.5 inches
 First sheet of veneer 3.0 inches



Depth below—

Log surface 2.9 inches
 First sheet of veneer 3.4 inches

Figure 9 (Continued)



Depth below—

Log surface	3.0 inches
First sheet of veneer	3.5 inches
Total Veneer Thickness	3.5 inches

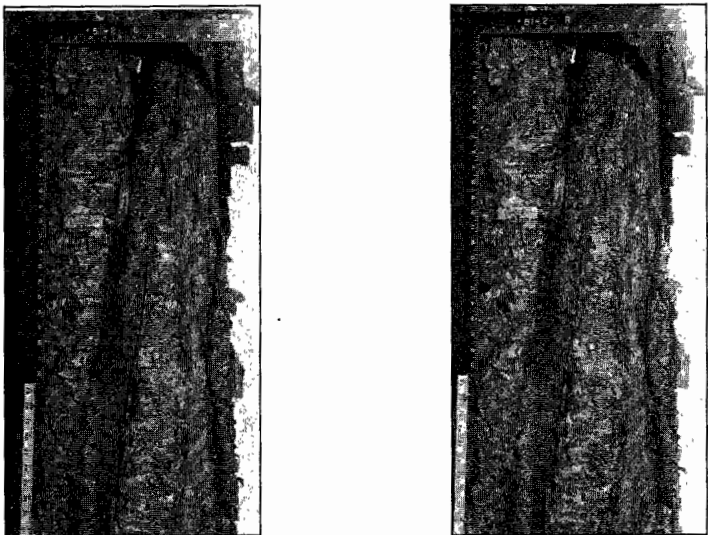
Seam

Overgrown seams, one of the exterior indicators of radial shakes, can cause serious degrade in logs and trees. A common misconception is that all seams are caused by frost, but they are most often initiated by wounds or limb stubs (Butin and Shigo 1981; Shigo and Larson 1969). However, frost is one of the major factors in maintaining the stress that causes the seams to persist for many years. Seams can be straight, though well over 50 percent are curved (a spiral appearance like spiral grain). It must be remembered that straight sound seams, those that can be considered as a line dividing two grading faces, can be disregarded as a defect (Rast et al. 1973). The seam in Figure 10 has a slight spiral shape and encased bark, both of which are normal. Seams must be considered potential serious degraders in factory-lumber and veneer logs as well as in the production of ties and timbers.

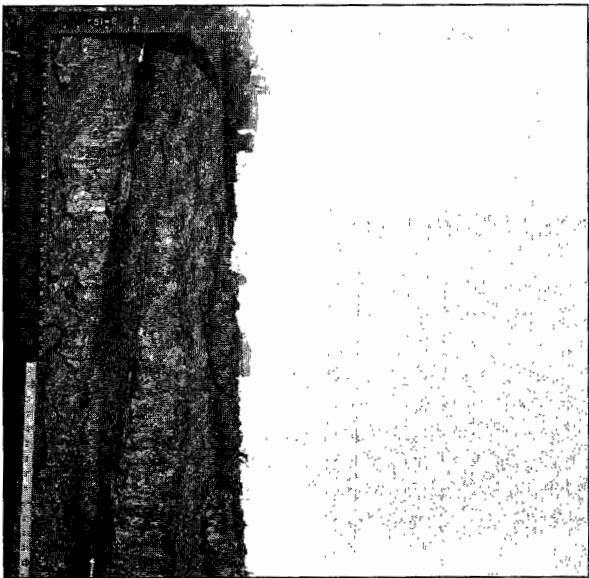
Gunshot (Slug) Damage

Gunshot wounds indicators, from a single slug, can be similar in appearance to certain insect attacks or small wounds. The gunshot indicator shown in Figure 11 looks very similar to a small, new wound, and could be classified that way since its effect on the underlying wood is very similar. The defect appears just below the surface of the log and extends slightly more than 2 inches into the log. The wound itself is about 3 by 1½ inches, but the associated stain extended 9 inches above and below the slug. Species is the major determinant of the amount of stain, since the hole is small and closes fairly rapidly, unlike that from insect damage which can be kept open for a period of time by insect activity, thus allowing more time for bacteria and other organisms to enter. Gunshot wounds can be doubly damaging, particularly in veneer logs. As in this example, the defect affected the outer 2 inches of potential veneer, which can be potentially damaging to the veneer knife.

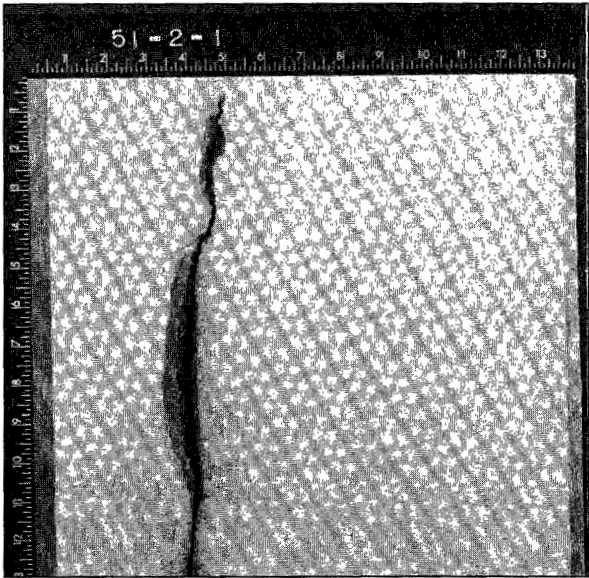
Figure 10.—Overgrown seam and associated internal defects.



Stereo view of defect indicator

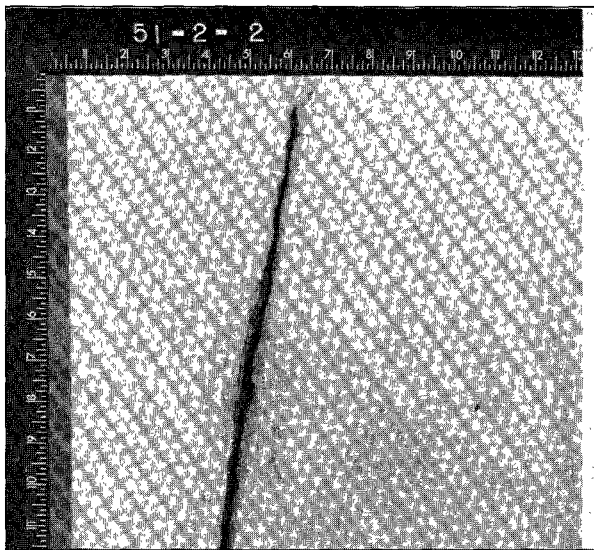


Defect size 40 × 2 inches
Log diameter at defect (ib) 18.0 inches
Round-up thickness 0.0 inch
Core diameter 5.9 inches
Defect distance above stump 4.0 feet



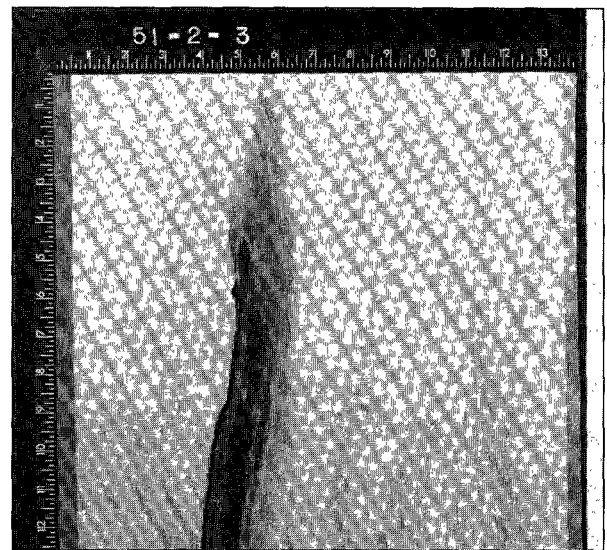
Depth below—
Log surface 4.3 inches
First sheet of veneer 4.3 inches

Figure 10 (Continued)



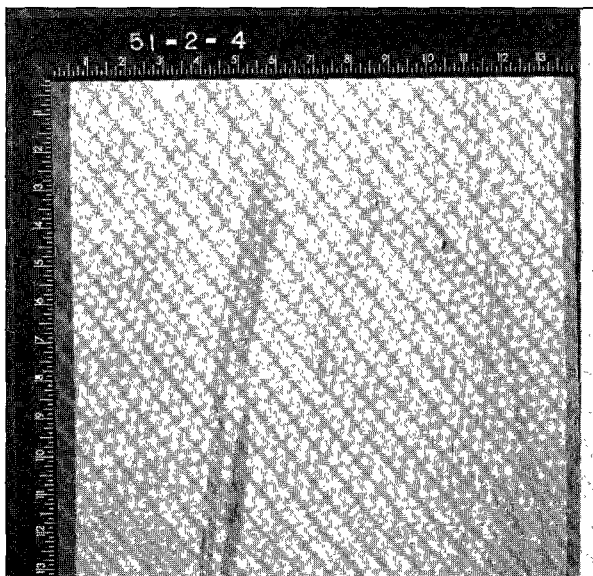
Depth below—

Log surface 4.8 inches
First sheet of veneer 4.8 inches



Depth below—

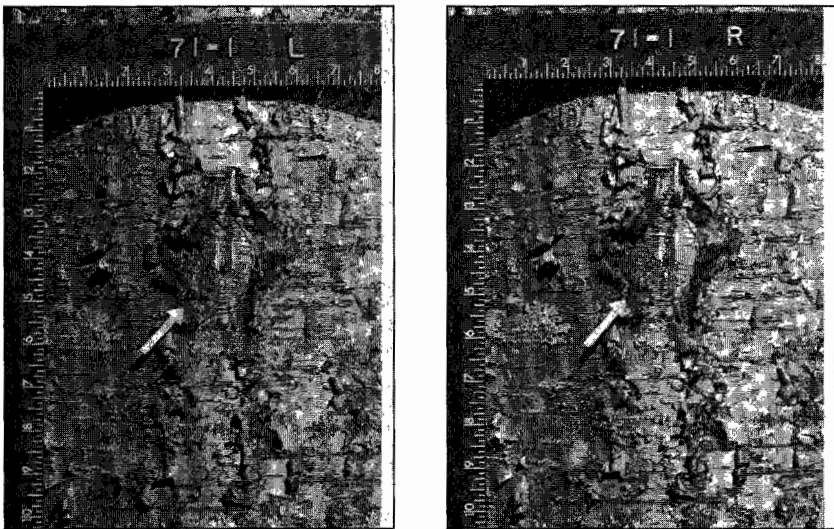
Log surface 5.1 inches
First sheet of veneer 5.1 inches



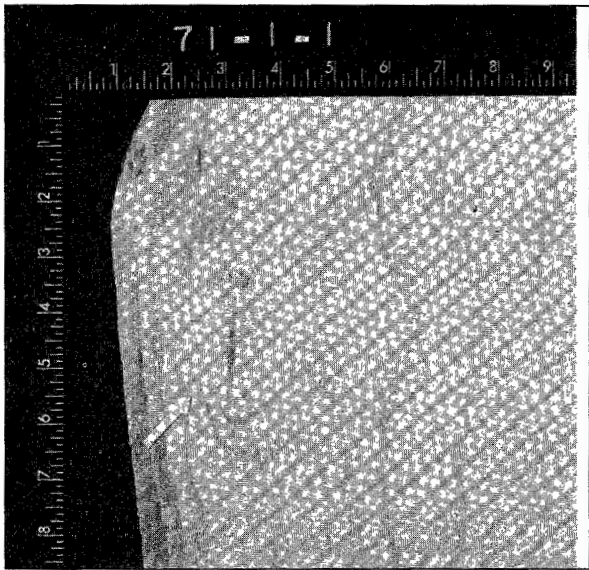
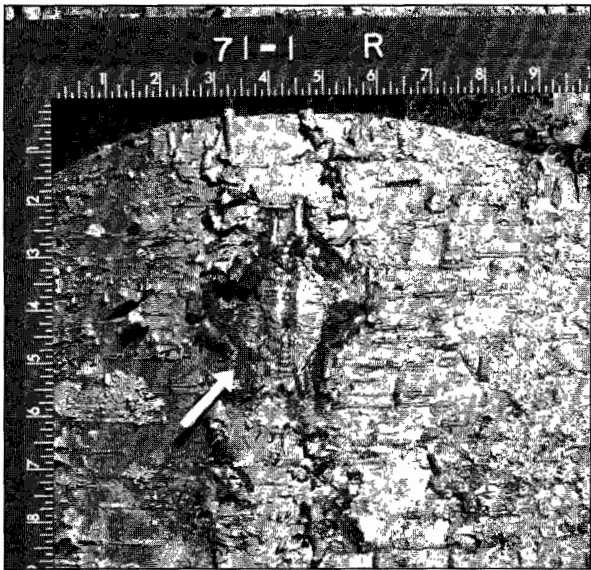
Depth below—

Log surface 5.3 inches
First sheet of veneer 5.3 inches
Total Veneer Thickness 6.5 inches

Figure 11.—Gunshot (slug) damage and associated internal defects.



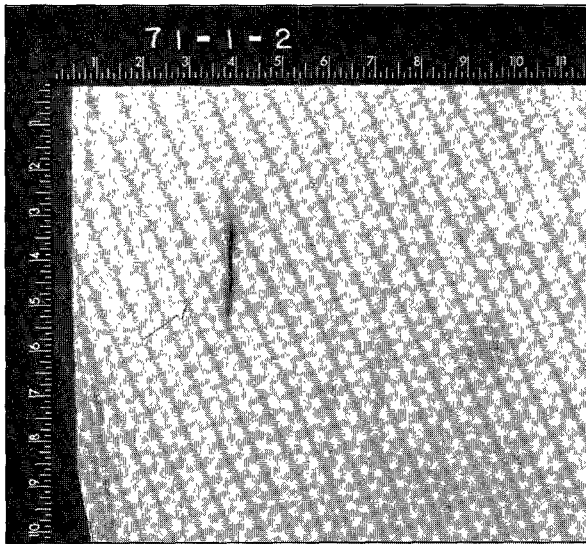
Stereo view of defect indicator



Defect size	2 x 2½ inches
Log diameter at defect (ib)	15.1 inches
Round-up thickness	0.2 inch
Core diameter	6.6 inches
Defect distance above stump	7.0 feet

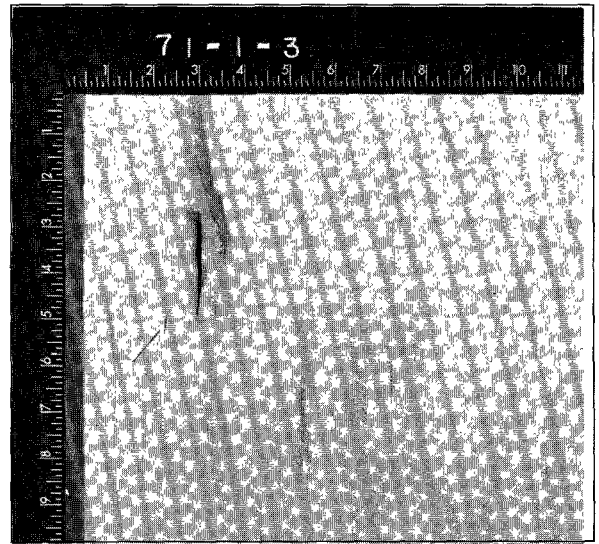
Depth below—	
Log surface	0.0 inch
First sheet of veneer	0.2 inch

Figure 11 (Continued)



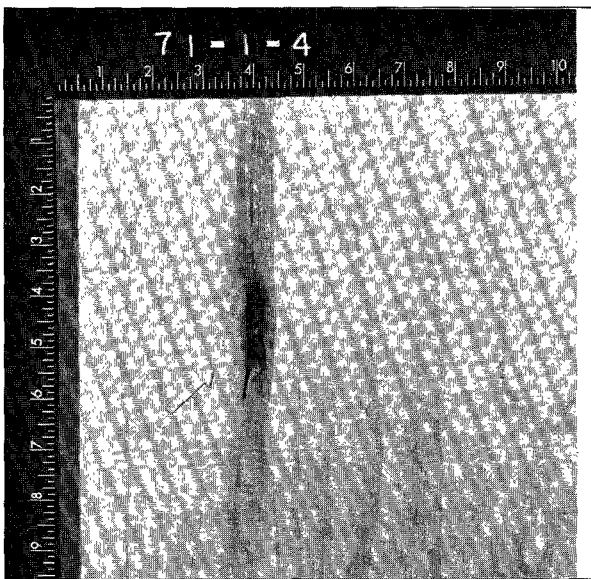
Depth below—

Log surface 0.5 inch
First sheet of veneer 0.7 inch



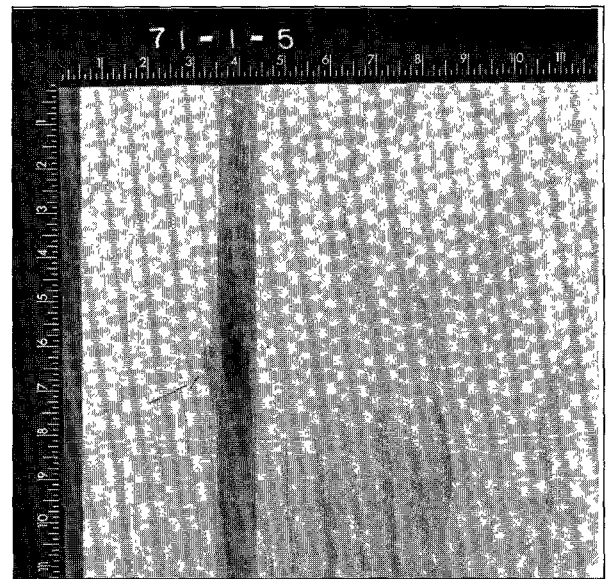
Depth below—

Log surface 0.9 inch
First sheet of veneer 1.1 inches



Depth below—

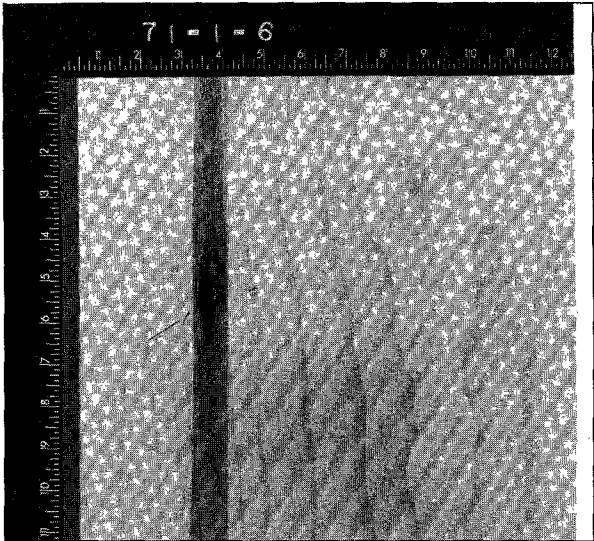
Log surface 1.0 inch
First sheet of veneer 1.2 inches



Depth below—

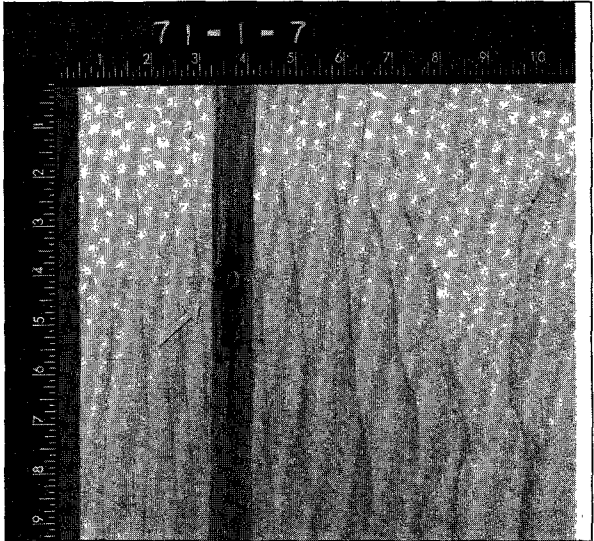
Log surface 1.2 inches
First sheet of veneer 1.4 inches

Figure 11 (Continued)



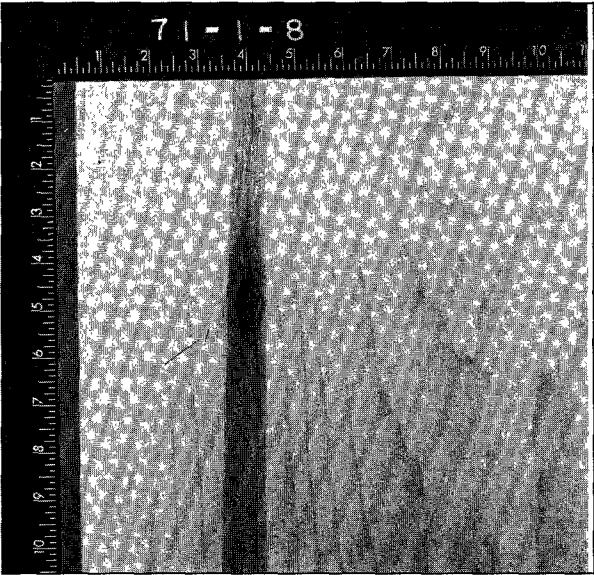
Depth below—

Log surface 1.3 inches
First sheet of veneer 1.5 inches



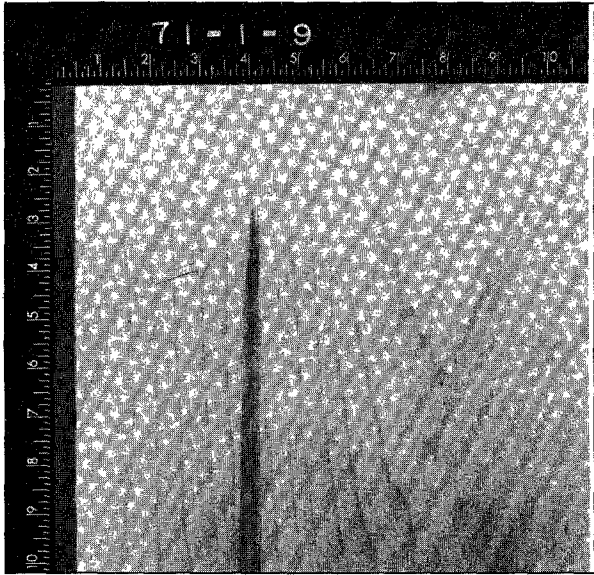
Depth below—

Log surface 1.4 inches
First sheet of veneer 1.6 inches



Depth below—

Log surface 1.8 inches
First sheet of veneer 2.0 inches



Depth below—

Log surface 2.1 inches
First sheet of veneer 2.3 inches
Total Veneer Thickness 4.1 inches

Acknowledgments

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Rast, Everette D., Beaton, John A., Sonderman, David L. 1990.

Photographic guide of selected external defect indicators and associated internal defects in yellow birch. Res. Pap. NE-648.

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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 yellow birch. 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; yellow birch; quality assessment

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