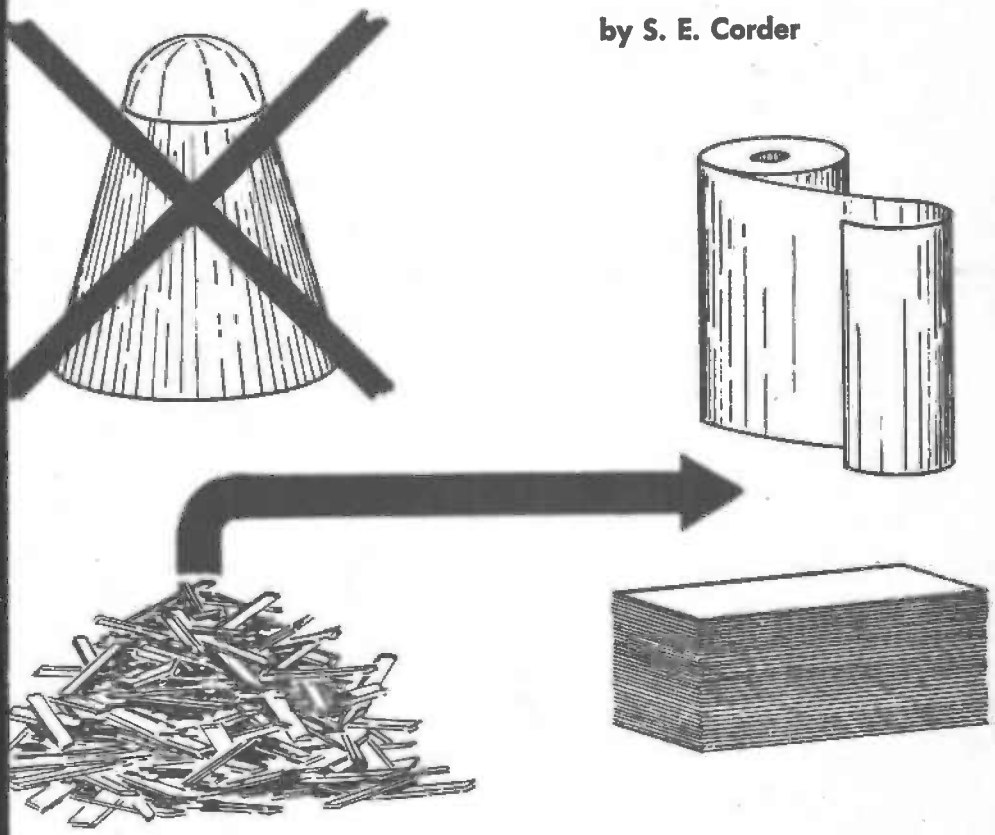
Oregon *Mill Residues* in 1953

by S. E. Corder



Information Circular 7 **May 1956**

Oregon Forest Products Laboratory

Scope of the Study - - -

Acknowledgments

Grateful acknowledgment is made of the cooperation and information given by various mill operators on which this report is most dependent. Appreciation is extended also to: the West Coast Lumbermen's Association, the Western Pine Association, and the Pacific Northwest Forest and Range Experiment Station for useful information.

Karl B. Bollerslev obtained field survey information on which the report is based. Contributions by staff members of the Oregon Forest Products Laboratory included valuable guidance from John B. Grantham, managing director, and photography by James L. Overholser. Drawings were executed by R. R. Magnuson and R. M. Winn, engineering students.

Oregon *Mill Residues* in 1953

by

S. E. Corder

Oregon Forest Products Laboratory
Corvallis, Oregon

USE OF WOOD RESIDUES IS INCREASING in importance for Oregon, to supplement raw materials for pulping without additional drain on forests.

A survey was conducted to determine quantities and disposition of wood residues from Oregon sawmills and plywood plants in 1953. About half the mill residues suitable for conversion to pulp or wood-composition boards was not used in 1953. This unused chippable residue amounted to about 2 million dry tons which, if completely utilized, could support a pulp production of about 2,740 tons of pulp per day. Over 1 million dry tons of chippable residue were used for fuel in 1953. This volume of residue, if used for pulp rather than for fuel, could support an additional pulp production of 1,500 tons per day.

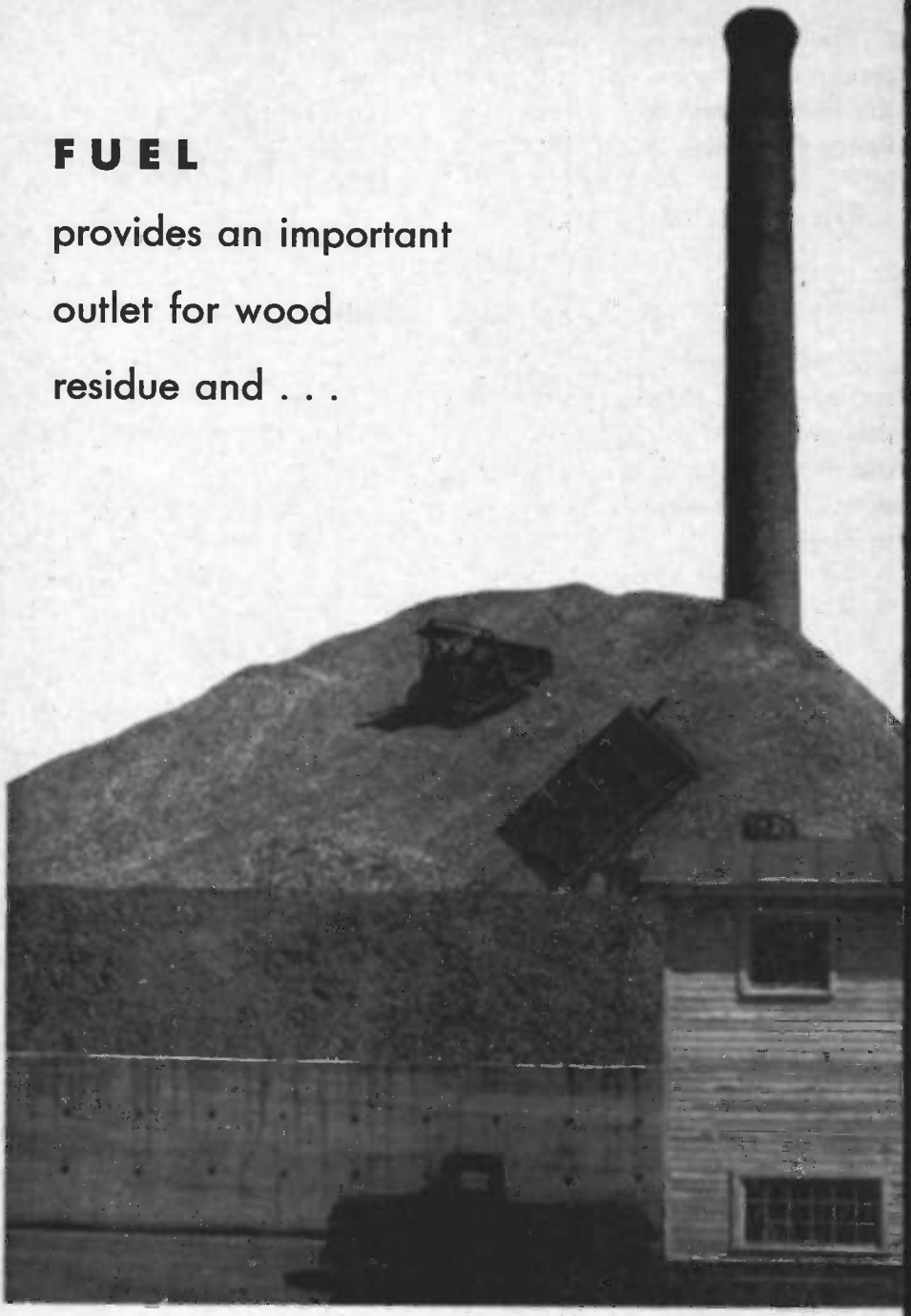
Economic problems of making material bark-free, and of transportation and collection from many small plants, impose limitations, however, on the use of part of this residue. Survey results show trends toward decreased use of wood residues for fuel, but marked increase in converting residues into pulp and wood-composition boards. There was, however, a large volume of mill residues remaining unused as a readily available potential source of wood raw material.

FUEL

provides an important

outlet for wood

residue and . . .



WHY A SURVEY?

The last inventory of sawmill residues in Oregon was made by the Pacific Northwest Forest and Range Experiment Station in 1944 (8).*

Changing economic conditions and rising demand for products that can be made from wood residues made desirable more recent information as to location and quantities of wood residues in the State.

Purpose and objectives

Primary purpose of the 1953 survey was to obtain information that would aid in expanding the use of sawmill and plywood residues. The survey was conducted to determine:

- Amount and type of sawmill and plywood residues produced in the State.
- General location of residues.
- Disposition of residues
- Changes in residue disposition since the 1944 survey.

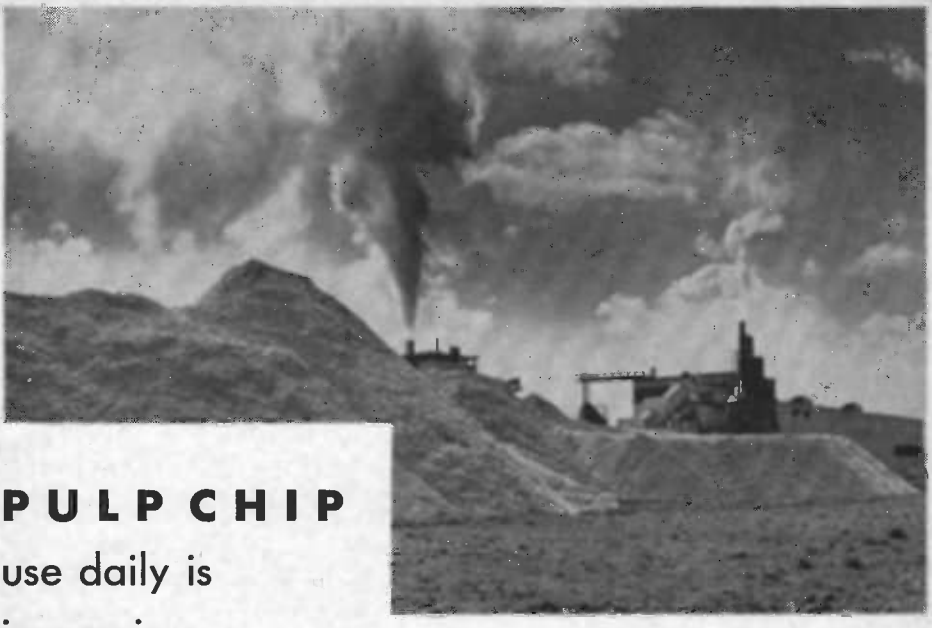
Oregon timber resources

Oregon leads the nation in production of lumber and plywood. The State produced 8½ billion board feet of lumber in 1953, accounting for about a quarter of the total lumber production in the United States. Oregon produced in 1953 about 1¾ billion square feet of plywood on a ⅜-inch basis, or about half the nation's production of softwood plywood. The logs required for this quantity of plywood would have made over ¾ billion board feet of lumber.

To support Oregon's wood industries, the State is rich in forest resources. About 30 million acres, or half the land in Oregon, is forest area. Oregon has the largest volume of standing timber of any state in the nation. The latest Forest Service inventory showed the State had about 396 billion board feet, Scribner log rule, of commercial sawtimber, or about one-fourth of the country's total sawtimber volume. Distribution of commercial sawtimber in the State is shown on page 16.

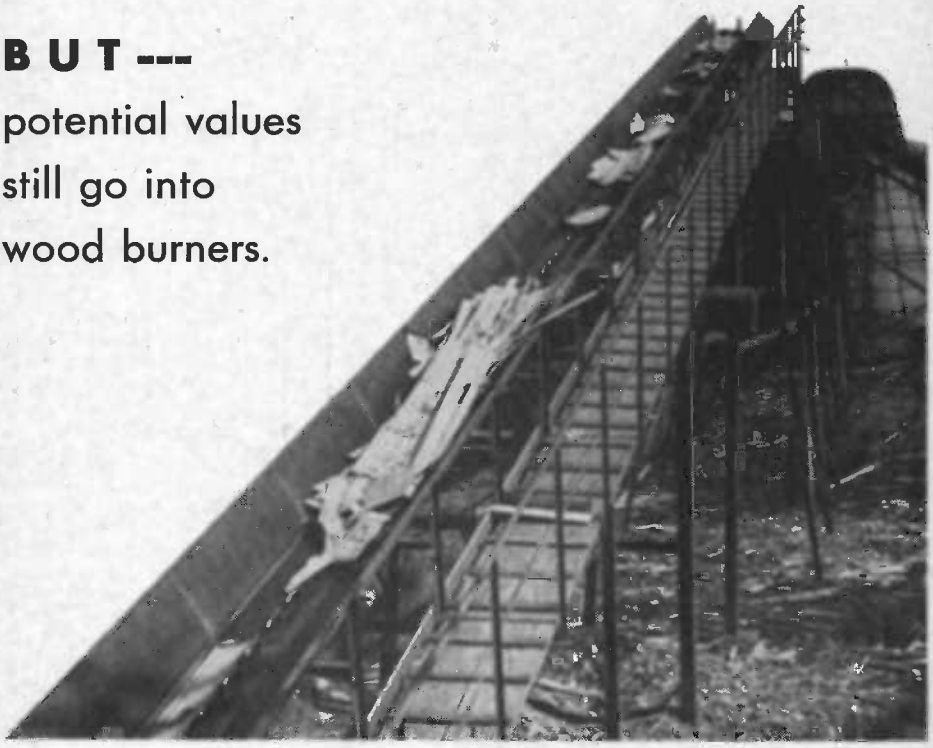
Future harvest of timber must be based on the capacity of forests to grow trees. There is not complete agreement among foresters, but it seems reasonable at this time to estimate sustained timber-growth capacity of the State at near the present timber-cutting rate. Under intensive forest management, the cut probably could be somewhat larger than at present. This growth capacity insures Oregon a continuing timber supply (5).

* Numbers in parentheses refer to like-numbered references listed at the end of the report.



PULP CHIP
use daily is
increasing . . .

BUT---
potential values
still go into
wood burners.



Wood residues

From standing tree in the forest to finished lumber or plywood, a significant portion of the tree does not end as lumber or plywood. Considerable material is left in the forest after logging. This material, or logging residue, is tops of trees, limbs, broken logs, and cull logs that cannot economically be manufactured into finished products. Logs brought to the sawmill or plywood plant cannot be converted entirely into the primary product. The portion of logs not converted into lumber or plywood will be referred to as mill residue in the present report. The report is concerned only with mill residues developed in lumber and plywood manufacturing operations and not with logging residues.

Production of mill residues in lumber and plywood manufacture presents a disposal problem for the mills. Mills cannot allow residue to accumulate because their operations soon would become clogged. There are outlets and uses for residues, but economic factors impose limitations that frequently make residue utilization unfeasible. Transportation and collection or concentration of residue are factors that often cause an economic roadblock to utilization. It is obvious that uses for residues must pay their way or the material will remain unused. This fact is shown by the presence of waste burners at the majority of sawmills in the State. Some mills, however, now operate without burners.

Recent trends in wood-residue utilization

Residue from lumber and plywood manufacture offers a large potential source of wood raw material. In the last decade, there has been a continued rise in cost for timber stumpage. Since use of residues is influenced strongly by economic conditions, rising cost of logs furnishes an economic stimulus toward more use of residues.

A significant recent development in the use of mill residues has been rapid expansion in their use for making paper and wood composition boards.* In 1955, a paper company in Oregon started operations depending entirely on mill residues for its wood supply (Page 4). Residue material in 1955 was transported up to 250 miles to some pulp plants. On page 16 are shown locations of sawmill and plywood plants, the producers of wood residue, and also the locations of those pulp and wood composition board plants that are users of wood residues in the State.

There were over 600 sawmills and over 100 plants that produced plywood or veneer. As of 1955, there were 11 wood composition board plants in Oregon with a combined output of about 700 tons per day. In addition, there were four particle or flake board plants either planned or under construction. There were, in 1955, 9 pulp mills in the State with a combined output of about 2,000 tons of pulp per day. Some Oregon sawmills and plywood plants also sold residue to pulp mills in adjoining states, principally Washington.

* Wood composition board as used herein includes softboard or insulation board, hardboard, particle board, chip board, and flake board. The term fiberboard is used loosely to cover all classes of wood composition boards, but more properly refers to softboard and hardboard.

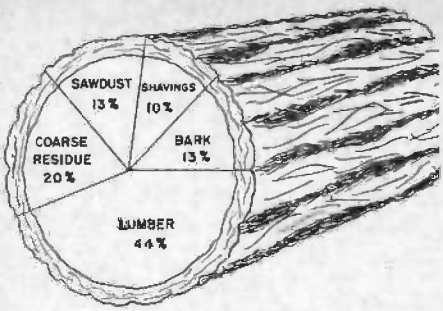


Figure 1. Products from lumber manufacture in western Oregon.

WHAT ABOUT RESIDUE FACTORS?

An intensive study was made at two sawmills in 1953 to establish current residue percentages and verify previous studies on residue estimating factors for lumber manufacture. An additional 1-day study of production was made at a green veneer plant to help establish residue percentages from plywood manufacture. Information reported by Oregon plywood plants aided in determining estimating factors.

Relative proportions of primary products and residues developed in conversion of logs to lumber or plywood in Oregon are shown graphically in Figures 1, 2, and 4. It was found that slightly more than half the log was converted to mill residue in lumber or plywood manufacture.

Sawmill residues

Residue percentages found in the two mills studied in 1953 agreed closely with percentages reported from previous studies (3, 6, 8). From these studies, residue estimating factors for sawmills were determined, as shown in Tables 1 and 2. Knowing volume of lumber cut, the different residues produced can be calculated by using these estimating factors.

Caution should be taken when dealing with conversion factors. They were intended to be used only as averages. There is considerable variation in residue developed between sawmills and also within a sawmill. Residue produced will vary with log size, log quality, type of saw used, size and kind of lumber produced, and type of sawmill equipment. Circular sawmills produce more sawdust than do band sawmills. Small logs give more coarse residue than do large logs. Larger mills usually produce less coarse residue per M fbm of lumber manufactured than do small mills, because of more remanufacturing and resawing operations at larger mills.

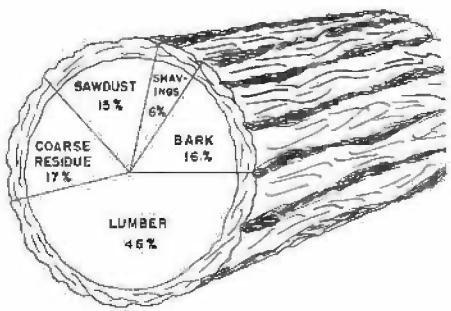


Figure 2. Products from lumber manufacture in eastern Oregon.

Conversion factors listed in Tables 1 and 2 were based on studies made at sawmills without chipping facilities. It is known that sawmills with chippers frequently get more coarse residue than indicated in the tables. This circumstance is caused primarily by changes in sawing and logging practices when a sawmill acquires a chipper. When a sawmill has a chipper, logs with a higher percentage of wood not suitable for lumber frequently are brought to the mill because much of

the residue can be converted into saleable pulp chips.

Factors in the tables are reported on the basis of lumber production. There is a difference in lumber tally and log scale. Western Oregon mills normally will produce in lumber about 15 per cent more board feet than the net log scale. In eastern Oregon the overrun from net log scale to lumber tally is usually about 10 per cent. Gross log scale is based on log dimensions without any reduction for defects. Frequently, overrun from net log scale to lumber and defect allowance are about the same. Gross log scale, therefore, commonly is nearly equivalent to lumber tally.

All residue was reported on the basis of tons of bone-dry wood. This means that the weight of water (present in wood in varying amounts) was not included in the weight reported. A ton of bone-dry wood is about equivalent to a unit (200 cubic feet) of hogged fuel, sawdust, or loose-packed pulp chips. Douglas fir pulp chips, which are compacted in loading, normally will contain about 2,400 pounds of bone-dry wood in 200 cubic feet. A cord of wood contains from 75 to 100 cubic feet of solid wood, depending on size and shape of the material. Thus, a cord of Douglas fir, at 28 lb dry wood per cu ft, contains from 1.0 to 1.4 tons of bone-dry wood. In the estimating factors, an average of 27.6 lb (dry) wood per cubic foot of solid wood was used in western Oregon and an average of 24 lb (dry) per cubic foot was used in eastern Oregon.

Sawmill residue can be grouped into two general classes: coarse residue and fine residue. Coarse residue includes slabs, edgings, and trim from the lumber. Fine residue consists of sawdust and planer shavings.

Slabs and edgings yield pulp chips at mills (Santiam Lumber Co. above), or at chipping plants (Longview Fibre, Inc. left).

Coarse residue

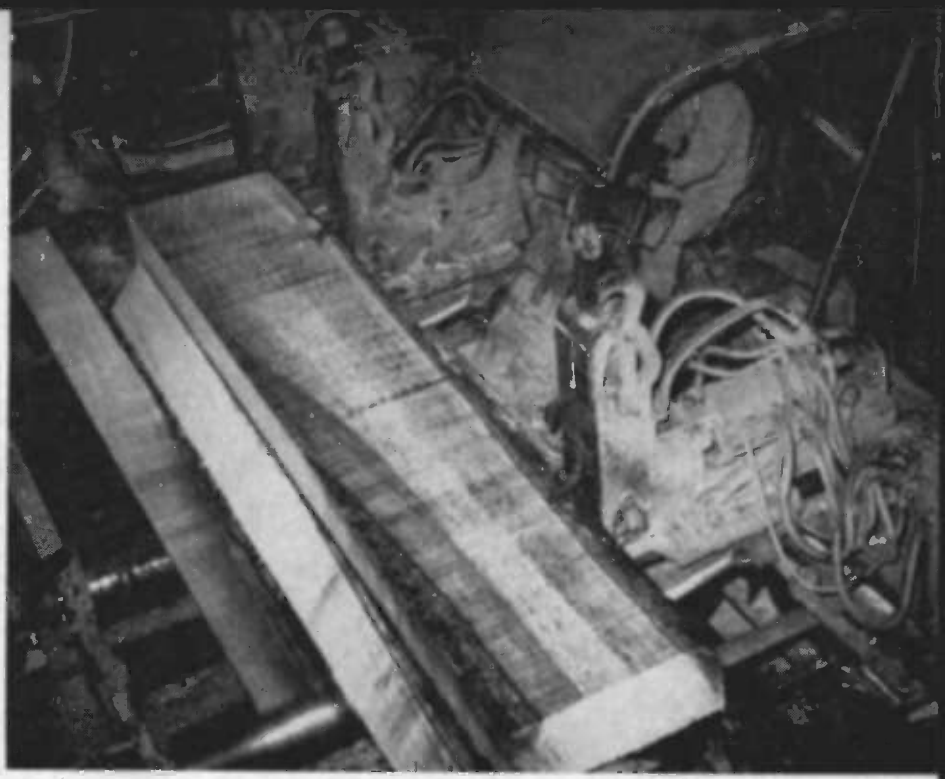
Coarse residue in the form of slabs and edgings is inevitable in lumber manufacture because logs are round and irregular, but lumber has a uniform rectangular section (Page 10). The manner in which slabs and edgings are produced is illustrated in Figure 3. From this figure, it is seen that slabs and edgings frequently have bark associated with wood unless the bark is knocked from the log in handling, or unless bark is removed from the log by barking equipment before the sawing operation.

Lumber trim is coarse residue that is produced by trimming defects such as knots from lumber or by trimming lumber to standard lengths. Lumber trim usually is bark-free.

Coarse residue is the residue material presently finding widest use for pulp and board manufacture. This material—if bark free—can be put through a chipping machine which reduces it to uniform-sized chips, the starting material for pulp and most composition board processes (Pages 8, 9). For this reason, coarse material frequently is called chippable residue. Coarse residue also is used for remanufacturing small wood items such as lath and broom handles. In addition, coarse residue is used to some extent for fuel (Page 6). As shown in Figure 1, about 15-20 per cent of logs entering the sawmill in 1953 were converted to coarse residue in Oregon.

Fine residue

Large volumes of sawdust are produced when saws are used to break down the log. Sawdust comes from head saw, edger, resaw, and trim saws. About 13-15 per cent of the log volume was reduced to sawdust dur-



Slabs and edgings are produced in lumber manufacture because logs are round, and lumber has a rectangular cross section.

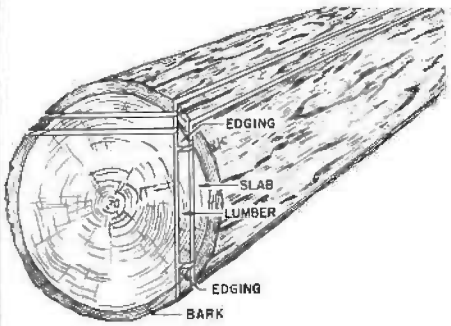


Figure 3. Typical sawing pattern in lumber manufacture.

ing lumber manufacturing operation in Oregon. There were, of course, variations between mills in the proportion of sawdust produced. Sawmills with band saws produced less sawdust than saw mills with circular saws because band saws may be thinner guage and have narrower saw kerf. Percentages shown in Figures 1 and 2 were general averages.

Sawdust presently is used mainly as fuel, with lesser amounts used in agriculture for such purposes as soil mulch. Sawdust has a potential use as a pulp raw material in which sawdust pulp probably would be used for blending with pulp made from normal pulp chips. Sawdust could provide short-fiber filler pulp.

When used as fuel (Page 2), wood normally has a useful heat output of about 11 million Btu (British thermal units) per ton of bone-dry wood. By comparison, heat obtained from a ton of bone-dry wood is equivalent to heat obtained from about 100 gallons of oil. With oil at a cost of $3.00 per 42-gallon barrel, a ton of dry wood gives the same heat as $7.00 of oil. A unit of hogged fuel contains about a ton of wood, on a dry-weight basis, and normally will produce about 10,000 pounds of steam.

Shavings are produced in finishing or planing lumber. Sawed lumber varies somewhat in size and has a rough surface. To obtain a smooth-surface product of uniform dimensions, lumber is put through a planer. This operation removes as much as 25 per cent of the lumber volume as shavings in producing some lumber items. On the average, however, about 6-10 per cent of a log that enters an Oregon sawmill will be converted to planer shavings.

Since lumber may be planed in a green condition or after it is dried, shavings occur both green and dry. About 80 per cent of planer shavings produced in western Oregon are green. Eastern Oregon has a higher proportion of dry shavings. Planer shavings are used at present mainly for fuel. Shavings are being used to a limited extent, however, for wood composition boards, wood briquets, and some agricultural items.

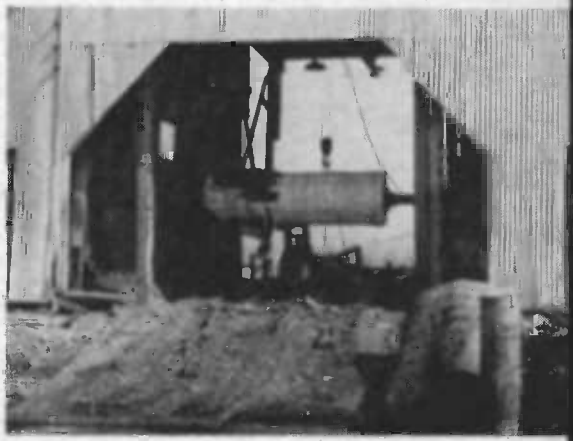
Bark

One residue from the log—bark—is a special form, since it is not wood. About 13 to 16 per cent of sawlog volume occurs as bark. If a sawmill has barking equipment, bark will be separated from wood (Page 22). If a sawmill does not have barking equipment, bark will be mixed with wood particles in the sawdust, and bark will be attached to wood on slabs and edgings.

In 1955, the only significant use of bark was for fuel. Bark has important potential use, however, in producing extractives. Wax, tannin, and well-drilling compounds are some extractives that can be obtained from bark. One company in the Pacific Northwest was selling commercial products made from bark—but this use was limited.

"Pond lily" is the term applied to short, round sections left from logs cut into veneer bolts. Their main use is as fuel.

Bark is removed from veneer bolts on a lathe, with a pressure arm or a rossing head. Sometimes bark is used as fuel.



Central cores of veneer bolts can be peeled on a small lathe for crossband veneer, sawed into specialty lumber, or chipped.

Plywood residues

Estimating factors for plywood residues were based on results of a study by the Oregon Forest Products Laboratory of residues produced at a plant making green Douglas fir veneer, and information supplied by manufacturers of veneer and plywood in Oregon. Estimated residue percentages listed in Table 4 were intended to indicate only averages, since there was much variation between and within plants.

Log trim

In plywood manufacture, logs are sawed at the plant into lengths of about 8 feet, 9 inches (Page 21). This log sectioning often results in short pieces from ends (Page 12). Short lengths are difficult to convert to chips. Their main use is for fuel.

Bark

The 8-foot, 9-inch lengths of log, called peeler blocks, go first to a barking lathe (Page 12). Here bark is removed from the block, resulting in bark residue, which has been discussed briefly under sawmill residues. Plywood plants differ from sawmills in that virtually all plywood plants separate bark from logs before they are processed, but many sawmills do not bark logs before sawing.

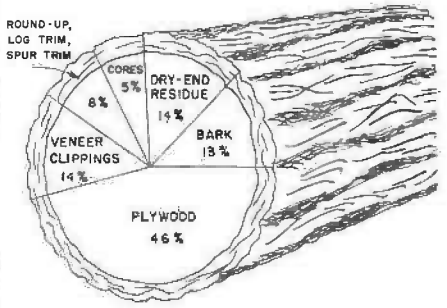


Figure 4. Products from plywood manufacture in western Oregon.

Round-up

After a block is barked, it is chucked in another lathe for peeling into veneer (Page 12). At start of the peeling operation, veneer does not come from the log in a continuous sheet since the log is not perfectly round. Material removed at the start of peeling is residue called **round-up;** sometimes referred to as "fish tails," because of the shape of the pieces. Round-up now is used mostly for fuel (Page 4).

Spur trim

As mentioned previously, peeler blocks are cut about 8 feet, 9 inches in length. When veneer is peeled from a block, it is trimmed to 8 feet 5 inches to give a veneer ribbon of uniform width. The short strips of veneer trim about 2 inches in width from each end of the block are called spur trim. Spur trim could be chipped, but seldom is because of its narrow size and its place of origin in the plant.

Green-veneer trim

Veneer is peeled from a log in a more or less continuous ribbon after the log has been rounded-up, or reduced to a perfect cylinder (Page 14). This ribbon of veneer is cut to certain lengths, commonly 27 or 54 inches, by a clipper. The clipper also serves to cut out defects such as knots, thereby producing narrow reject strips called veneer clippings or green-veneer trims. These clippings or trims are the residue now frequently converted to pulp chips at plywood plants (Page 15). Green-veneer trim normally

Peeling Douglas fir veneer bolts into long sheets of veneer.
(Photo by American Forest Products Industries—Douglas Fir Plywood Association.)

Bundled peeler cores awaiting pulp chipping at Longview Fibre, Inc., a concentration yard located north of Eugene.

accounts for about 14 per cent of total log volume.

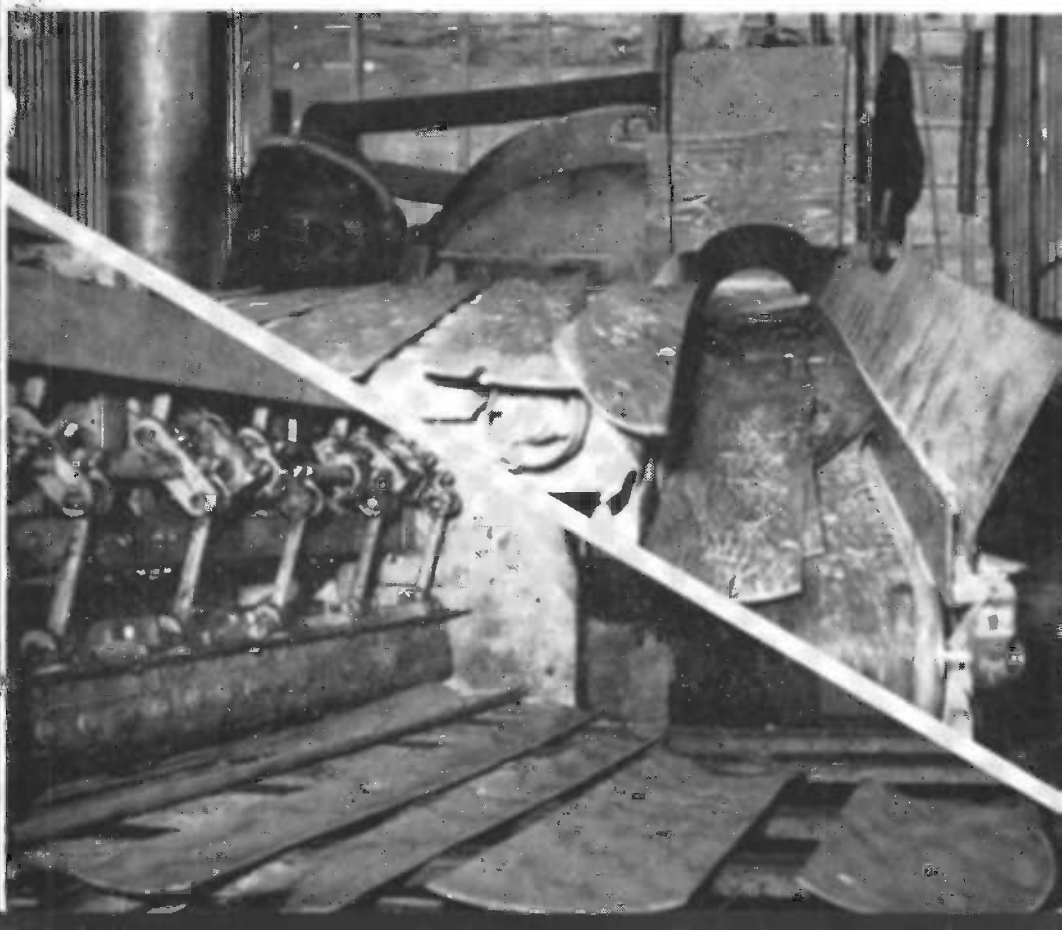
Cores

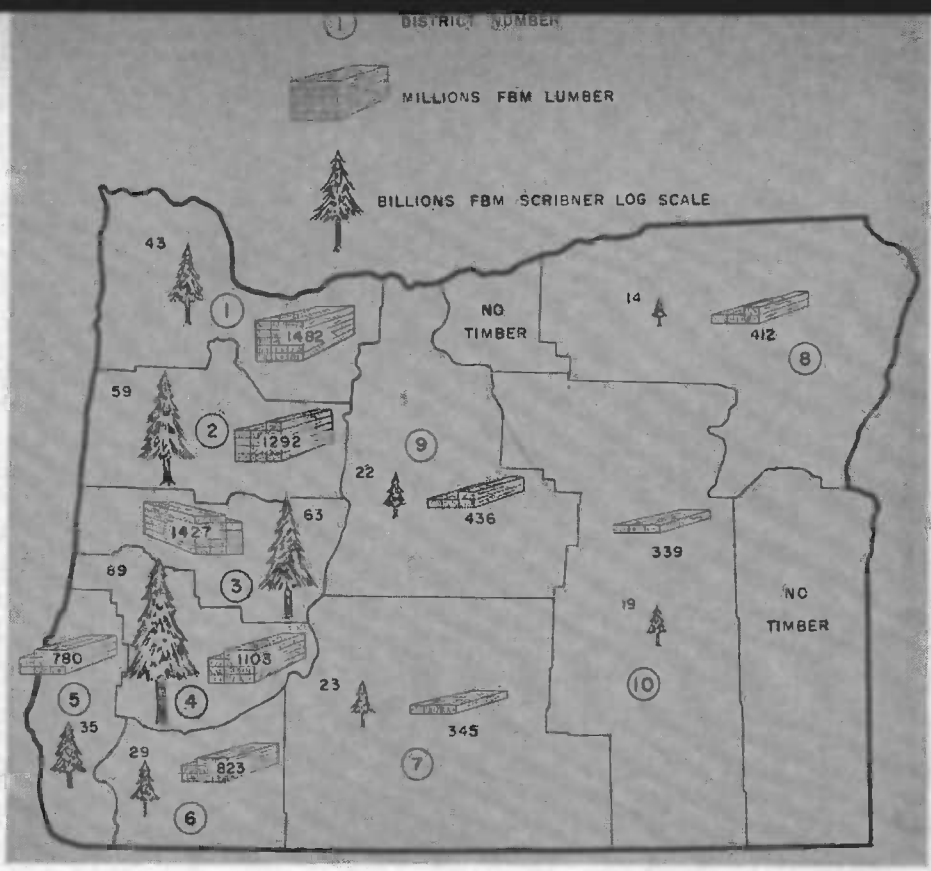
A peeler block may be 3 or 4 feet in diameter initially. Since a block is held in the lathe by chucks, the block cannot be peeled to a diameter smaller than the chucks that hold the peeler block. Sometimes the piece is removed from the main lathe and put in a small lathe for further peeling, but a small cylinder of wood always remains (Pages 12, 14). This cylinder, called a core, normally will be from 6 to 15 inches in diameter and about 8 feet long. If the core is peeled in a small lathe, it is usually cut into two 4-foot lengths. Cores are a residue frequently sawed into 8-foot studs, or into short pieces of specialty lumber (Page 18). Cores can be made into chips, but a different chipper is required than one used for green-veneer trim. Some use is made of cores for fuel.

Dry-end residue

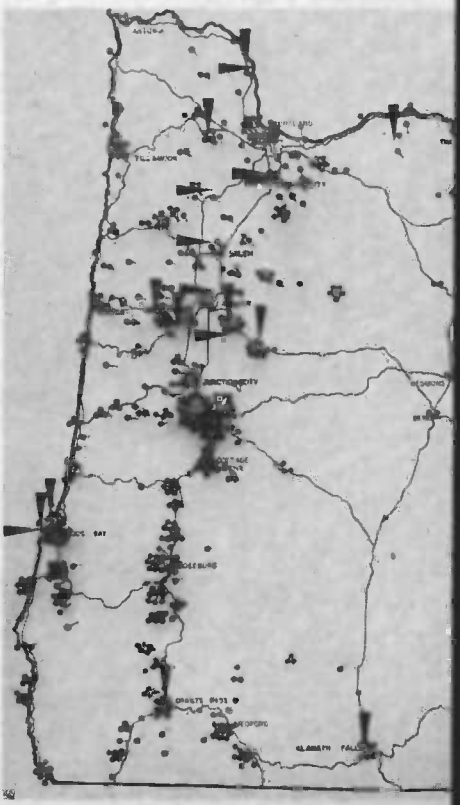
After veneer is produced, it is dried and laid-up in panels. Panels are sanded to a smooth surface and trimmed to a standard size. Sander dust, panel trim, and miscellaneous breakage can be called dry-end residue since the residue is from dry wood. Sander dust finds limited use as a filler in such items as linoleum manufacture, but the main use of sander dust and panel trim is fuel.

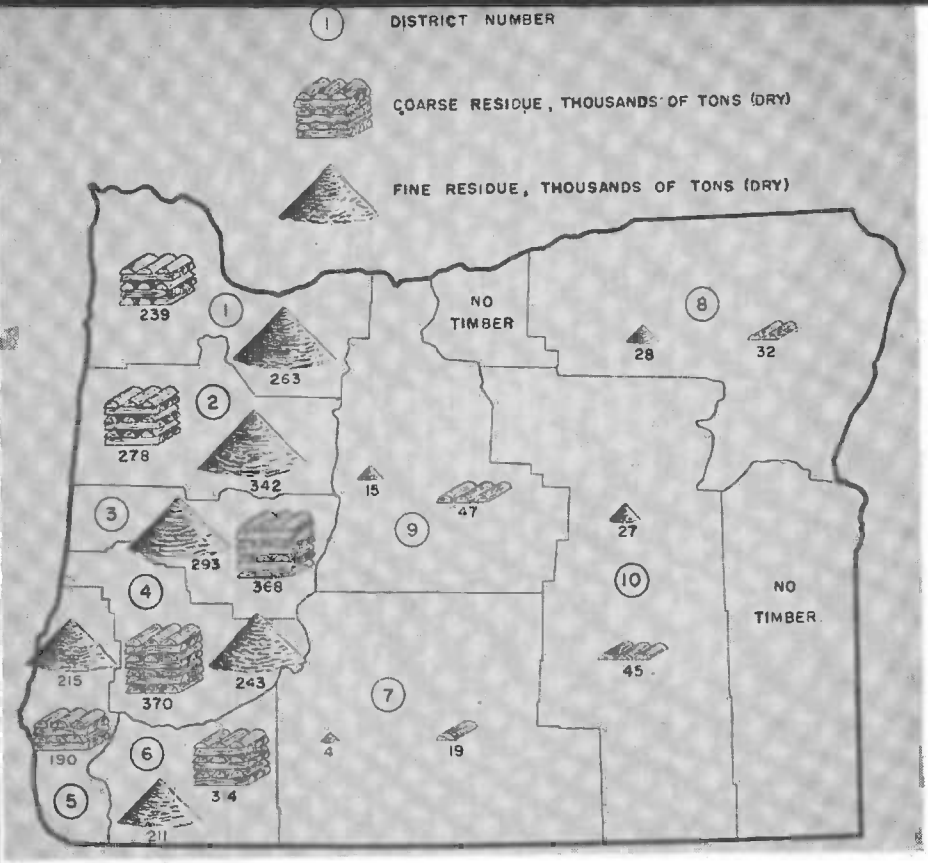
Veneer trim and "fishtails"—irregular pieces from rounding up veneer billets—make excellent pulp chips, as at Mary's Peak Veneer, Inc. (below).





Lumber production and sawtimber volume by districts for Oregon in 1953.





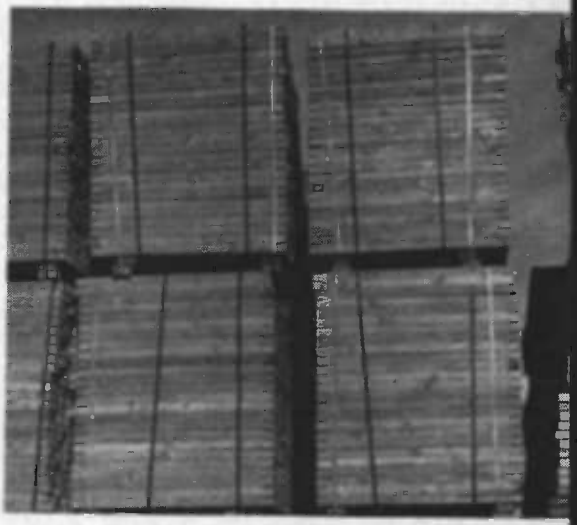
Unused sawmill residues in Oregon by districts in 1953.

Table 1. Average Residues Developed From Lumber Manufacture in Western Oregon During 1953

Item	Solid volume	Dry weight
	*Cubic feet**	*Tons**
Wood residue		
Coarse residue	32.1	0.443
Sawdust	20.5	0.283
Shavings	15.0	0.207
Bark	67.6	0.933
	20.8	0.287
All residue	88.4	1.220
Lumber	69.1	0.954
Whole log	157.5	2.174

* Per thousand board feet of lumber.

Specialty lumber—such as 8-foot studs, or cable reel parts—as seen to the right, can be sawed from most round lathe cores, as shown below . . .



. . . a byproduct of the peeling of Douglas fir veneer in western Oregon. Here a truckload of peeled veneer goes from green veneer plant to plywood mill.

HOW SAWMILLS WERE SURVEYED . . .

The State was divided into 10 districts for the survey. These districts were chosen mainly as convenient geographical units with consideration given to available transportation facilities. Counties included in each district are illustrated on page 16.

In the sawmill survey, mills were listed in 2 classes: those cutting over 80 M fbm lumber per shift and those cutting less than 80 M fbm per shift. A sampling of sawmills was made to determine lumber cut in 1953 and disposition of each form of residue. One hundred and twenty-six sawmills were visited; 68 mills in the class cutting over 80 M fbm per shift; 58 mills in the class cutting less than 80M fbm per shift. Total residue and its disposition was projected for each district on the basis of the sampling.

Mills visited produced 48 per cent of lumber cut in the State in 1953. Mills sampled cutting over 80 M fbm per shift and mills sampled cutting less than 80 M fbm per shift accounted for 64 per cent and 22 per cent, respectively, of total lumber cut by mills in each size class.

Lumber production statistics were obtained from information furnished by the West Coast Lumbermen's Association and the Western Pine Association.

Reliability of the survey was influenced by the fact that the average residue estimating factors used were not expected to be exact but were taken as the best averages available. Not all mills were visited, but, since mills visited cut 48 per cent of all lumber produced in Oregon in 1953, the sampling was considered representative of sawmills for the State. Figures reported should give a close approximation of wood-residue status at the time of survey.

Table 2. Average Residues Developed From Lumber Manufacture in Eastern Oregon During 1953

Item	Solid volume	Dry weight
	*Cubic feet**	*Tons**
Wood residue		
Coarse	26.1	0.313
Sawdust	22.0	0.264
Shavings	9.4	0.113
	57.5	0.690
Bark	23.3	0.279
All residue	80.8	0.969
Lumber	69.1	0.828
Whole log	149.9	1.797

* Per thousand board feet of lumber.

Plywood for rough sheathing can be made from logs containing defects, such as knots or white speck from Fomes pini fungus. This practice leads to close utilization in the woods, with an added advantage of residues at mills where they are readily accessible for conversion.

Table 3. Fine Residue (Sawdust and Shavings) Disposition for Oregon in 1953*

Location	Fuel	Not used
	Per cent	*Per cent*
District 1	64	36
2	46	54
3	58	42
4	55	45
5	44	56
6	48	52
Western Oregon	54	46
District 7	97	3
8	82	18
9	90	10
10	80	20
Eastern Oregon	87	13
All Oregon	58	42

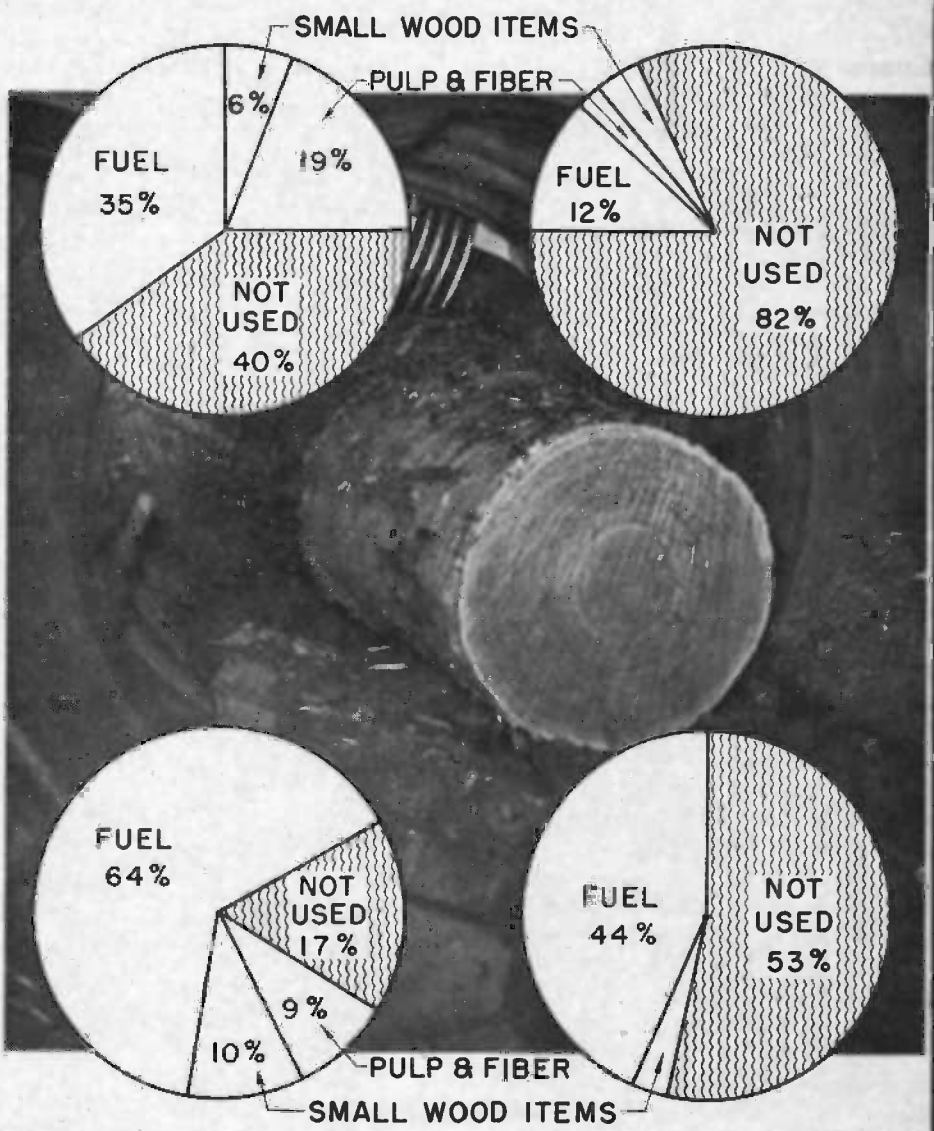
* Bark is not included.

HOW PLYWOOD PLANTS WERE SURVEYED . . .

Disposition of green veneer trim and cores at individual plants was obtained from virtually all plywood and veneer plants in the State. Plywood production statistics supplied by the Douglas Fir Plywood Association were used, with estimating factors listed in Table 4 to calculate total residue produced.

For listing plywood residues, the State was divided into districts as was done for sawmills (Table 7). There were differences, however: several districts in eastern and central Oregon contained no plywood plants and, consequently, were not listed. In addition, Klamath County was included in District 6.

WESTERN Oregon coarse-residue disposition from large and small sawmills compared to . . .



EASTERN Oregon coarse-residue disposition from lumber manufacturing in large and small sawmills.

RESULTS OF THE SURVEY

Sawmill survey results are shown in Table 6 and on page 17.

Sawmill residues

Coarse residue

The disposition of coarse sawmill residue is shown in Table 5. Districts 1, 2, 3, and 8 were areas using coarse residue for pulp and fiber production. High percentages of coarse residue in districts in the southern part of the State were unused. Western Oregon used a higher percentage of coarse residue for pulp and fiber than did eastern Oregon; 12 per cent and 5 per cent, respectively. Location of pulp and composition board plants largely accounted for the above differences. Eastern Oregon, however, used a larger percentage of coarse residue for fuel—57 per cent—as contrasted with 26 per cent in western Oregon.

Change in disposition of coarse residue in western Oregon from 1944 to 1953 is shown in Figure 5. Total coarse residue produced in western Oregon increased from 2 million tons (dry) in 1944 to 3 million tons in 1953. Increased residue resulted from a corresponding increase in lumber production. A significant change in coarse-residue disposition from 1944 to 1953 was increased use for pulp and fiber. Only 1,350 tons (dry) of residue were used for pulp and fiber in 1944, but this amount increased to 363,000 tons in 1953, or an increase from less than 1 per cent to about 12 per cent of the total coarse residue. Use of coarse residue for fuel decreased from 1,350,000 tons in 1944 to 781,000 tons in 1953, or from 67 per cent to 26 per cent of the total. Unused coarse residue increased from 635,000 to 1,759,000 tons in the 9-year period.

Differences in coarse-residue disposition between large and small mills in western Oregon are illustrated on page 22. Difficulty in using residues economically in small mills is apparent, since coarse residue from small mills was 82 per cent unused, but coarse residue from large mills was only about 40 per cent unused.

Change in disposition of coarse residue in eastern Oregon from 1944 to 1953 is illustrated in Figure 6. Lumber production for the 9-year period decreased slightly, from 1,614,000 to 1,532,000 board feet, resulting in a slightly lower total residue. There was no use of coarse residue for pulp and fiber in 1944; but in 1953, 26,000 tons of coarse residue—5 per cent of the total—were used for pulp and

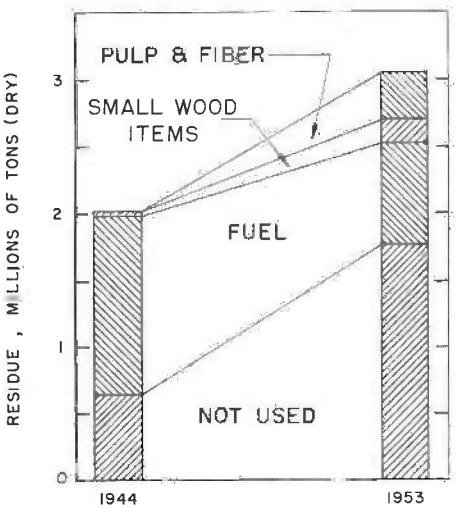


Figure 5. Coarse residue disposition in western Oregon sawmills.

fiber. Use of coarse residue for small wood items such as lath increased from 1 per cent to 8 per cent, and fuel uses decreased from 76 per cent to 58 per cent of the total. Unused coarse residues increased slightly from 23 per cent to 30 per cent of the total.

Coarse-residue dispositions from classes of large and small mills in eastern Oregon are compared on page 22. As in western Oregon, there was a considerably higher proportion of unused residue in small mills. Mills over 80 M fbm daily capacity had 17 per cent of their coarse residue unused, but mills of less than 80 M fbm daily capacity had 53 per cent unused.

Fine residue

The only significant use of fine residues, which included sawdust and shavings, was for fuel. Percentage disposition of fine residue in each of the districts is shown in Table 6. About half the fine residue in western Oregon was used for fuel, with the other half unused. Eastern Oregon sawmills used 87 per cent of their fine residue for fuel, leaving only 13 per cent unused. One reason for larger proportionate use for fuel in eastern Oregon than in western Oregon was that a larger proportion of lumber in eastern Oregon was kiln-dried. Dry kilns require steam, frequently produced by using mill residue for fuel.

Change in disposition of fine residues in western Oregon from 1944 to 1953 is shown in Figure 7. Total fine residue increased from 2,224,000 to 3,384,000 tons (dry). While use for fuel increased from 1,644,000 to 1,817,000 tons (dry), the percentage used for fuel decreased from 74 per cent of the total in 1944 to 54 per cent in 1953.

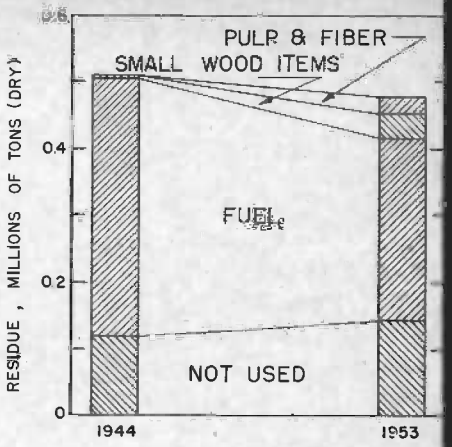


Figure 6. Coarse residue disposition in eastern Oregon sawmills.

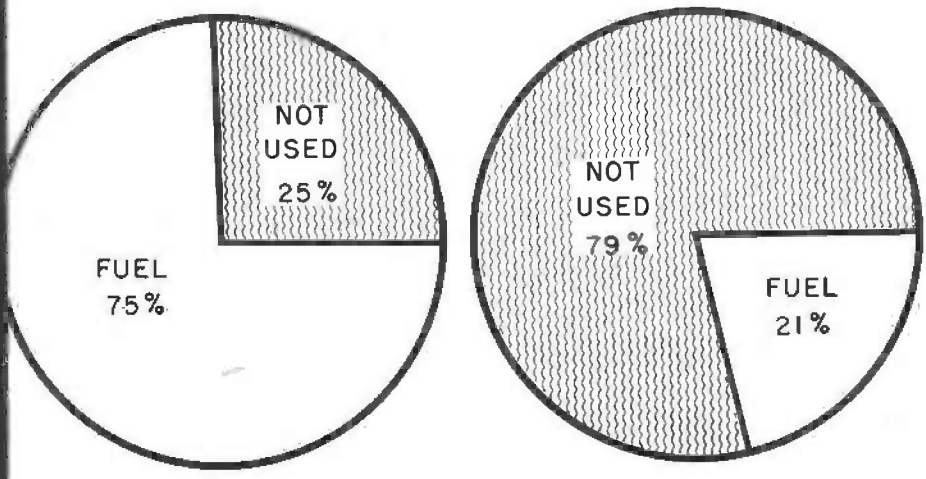
Differences in fine-residue disposition between small and large mills in western Oregon is shown on page 25. Large mills used three-fourths of their fine residue for fuel, and did not use one-fourth. Small mills' usage was the reverse, since they used 21 per cent for fuel and had 79 per cent remaining unused.

Change in disposition of fine residues for eastern Oregon between 1944 and 1953 is represented graphically in Figure 8. There was no marked change in quantities and proportions for the 9-year interval.

Fine-residue disposition by mill-size class is shown on page 26. Both large and small mills used a large portion of their fine residue for fuel in eastern Oregon.

Bark

Disposition of bark was not determined in the survey. Production of bark is given, however, in Table 6. Only significant use of bark in 1953 was for fuel. It was estimated that over half the 2,400,000 tons of bark produced annually in the State was not used at the time of survey.



Comparison of fine-residue disposition from lumber manufacture in large and small sawmills of western Oregon.

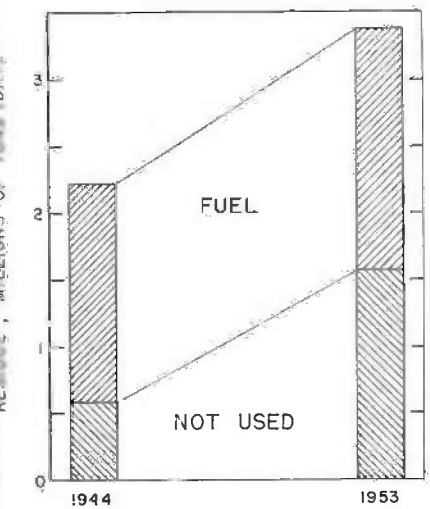


Figure 7. Fine residue (sawdust and shavings) disposition in western Oregon lumber manufacture.

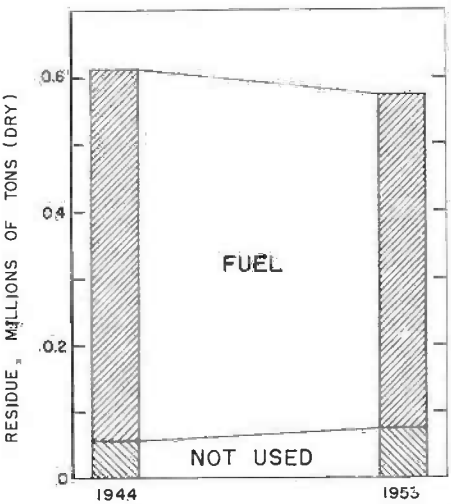
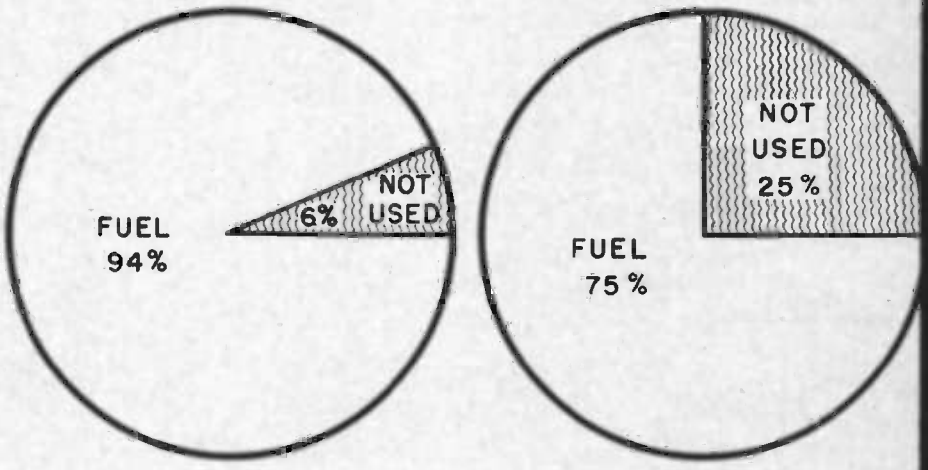


Figure 8. Fine residue (sawdust and shavings) disposition in eastern Oregon lumber manufacture.

Table 4. Average Residues Developed From Plywood Manufacture i Western Oregon During 1953

Item	Solid volume	Dry weight
	*Cubic feet**	*Tons**
Wood residue		
Cores	3.5	0.049
Veneer clippings	9.6	0.134
Round-up, log trim, and spur trim	5.5	0.077
Dry-end residue	9.6	0.134
	28.2	0.394
Bark	9.1	0.126
All residue	37.3	0.520
Plywood	31.3	0.438
Whole log	68.6	0.958

* Per thousand square feet of plywood, ⅜-inch basis.



Comparison of fine-residue disposition from lumber manufacture in large and small sawmills of eastern Oregon.

Plywood residues

Results of the survey of plywood ill residues are shown in Table 7. otal production was 1,752,000,000 quare feet of 3/8-inch-equivalent ply- ood in 1953. Volume of logs used plywood manufacture amounted to bout 10 per cent of volume of logs sed for making lumber. Production f plywood was about evenly divided one-fifth of the total for each of e districts 1 through 5, with district contributing only 6 per cent.

Residue disposition is shown only or green-veneer trim and cores pro- uced by 55 plants peeling veneer 1953. Green-veneer trim produced was 234,000 tons (dry). Disposition was 40 per cent to pulp and fiber, 25 per cent to fuel, and 35 per cent not used. As shown in Table 7, most use for pulp and fiber was in districts 1, 2, and 3, in the northwest section of the State where pulp and fiber plants are concentrated.

Cores produced from plywood manufacture amounted to 85,000 tons (dry). Seventy-three per cent of this material was remanufactured into such items as short 2- by 4-inch lumber, 10 per cent was used for fuel, and 17 per cent was not used.

- **About 91,000 tons of plywood residue were made into pulp in 1953.**
- **Some 97,000 tons of plywood residue suitable for pulp were not used.**
- **This unused residue could support pulp production of 140 tons a day.**

Table 5. Disposition of Coarse Residue in Oregon for 1953*

District	Fuel	Remanufactured	Pulp and fiber	Not used
	Per cent	*Per cent*	*Per cent*	*Per cent*
1	37	4	23	36
2	35	1	16	48
3	16	6	20	58
4	14	11	0	75
5	38	7	0	55
6	12	2	0	86
Western Oregon	26	5	12	57
7	80	3	0	17
8	53	5	14	28
9	53	15	0	32
10	60	6	0	34
Eastern Oregon	57	8	5	29
All Oregon	30	5	11	54

* Does not include bark.

Table 6. Production and Disposition of Sawmill Residues in Oregon in 1953

Mill location	Mill size class	1953 Lumber production	Residue developed in 1953				Used for fuel*			Coarse material used for:		Residue not utilized		
			Coarse	Sawdust	Shavings	Bark†	Coarse	Sawdust	Shavings	Small items	Pulp & fiber	Coarse	Sawdust	Shavings
	M fbm per shift	*MM fbm*	*M tons‡*	*M tons‡*	*M tons‡*	*M tons‡*	*M tons‡*	*M tons‡*	*M tons‡*	*M tons‡*	*M tons‡*	*M tons‡*	*M tons‡*	*M tons‡*
District 1		1,482	656	419	307	425	240	257	206	29	148	239	162	101
	over 80	872	386	247	181	250	165	242	156	15	139	67	5	25
	under 80	610	270	172	126	175	75	15	50	14	9	172	157	76
District 2		1,292	572	366	268	371	199	178	114	5	90	278	188	154
	over 80	762	337	216	158	219	181	176	109	2	90	64	40	49
	under 80	530	235	150	110	152	18	2	5	3	0	214	148	105
District 3		1,427	633	404	295	409	103	221	185	37	125	368	183	110
	over 80	841	373	238	174	241	77	172	112	24	114	158	66	62
	under 80	586	260	166	121	168	26	49	73	13	11	210	117	48
District 4		1,103	489	312	228	317	67	206	91	52	0	370	106	137
	over 80	749	332	212	155	215	67	181	88	50	0	215	31	67
	under 80	354	157	100	73	102	0	25	3	2	0	155	75	70
District 5		780	346	221	161	224	131	129	38	25	0	190	92	123
	over 80	460	204	130	95	132	111	108	34	18	0	75	22	61
	under 80	320	142	91	66	92	20	21	4	7	0	115	70	62
District 6		823	364	233	170	236	41	120	72	9	0	314	113	98
	over 80	486	215	138	100	139	32	94	52	4	0	179	44	48
	under 80	337	149	95	70	97	9	26	20	5	0	135	69	50
Western Oregon		6,907	3,060	1,955	1,429	1,982	781	1,111	706	157	363	1,759	844	723

District 7		224	70	59	25	62	60	59	23	3	0	7	0	2
	over 80	121	38	32	14	34	26	31	13	0	0	12	1	1
	under 80													
District 8		345	108	91	39	96	86	90	36	3	0	19	1	3
	over 80	246	77	65	28	68	29	58	28	9	26	13	7	0
	under 80	166	52	44	18	46	33	29	12	0	0	19	15	6
District 9		412	129	109	46	114	62	87	40	9	26	32	22	6
	over 80	330	103	87	37	92	66	87	24	15	0	22	0	13
	under 80	106	33	28	12	29	4	28	10	4	0	25	0	2
District 10		436	136	115	49	121	70	115	34	19	0	47	0	15
	over 80	197	62	52	22	55	45	52	21	5	0	12	0	1
	under 80	142	44	37	16	38	10	21	6	1	0	33	16	10
		339	106	89	38	93	55	73	27	6	0	45	16	11
Eastern Oregon		1,532	479	404	172	424	273	365	137	37	26	143	39	35
All Oregon		8,439	3,539	2,359	1,601	2,406	1,054	1,476	843	194	389	1,902	883	758

* Includes fuel sold and fuel used by mills.
† Disposition of bark was not determined.
‡ Dry-weight basis.

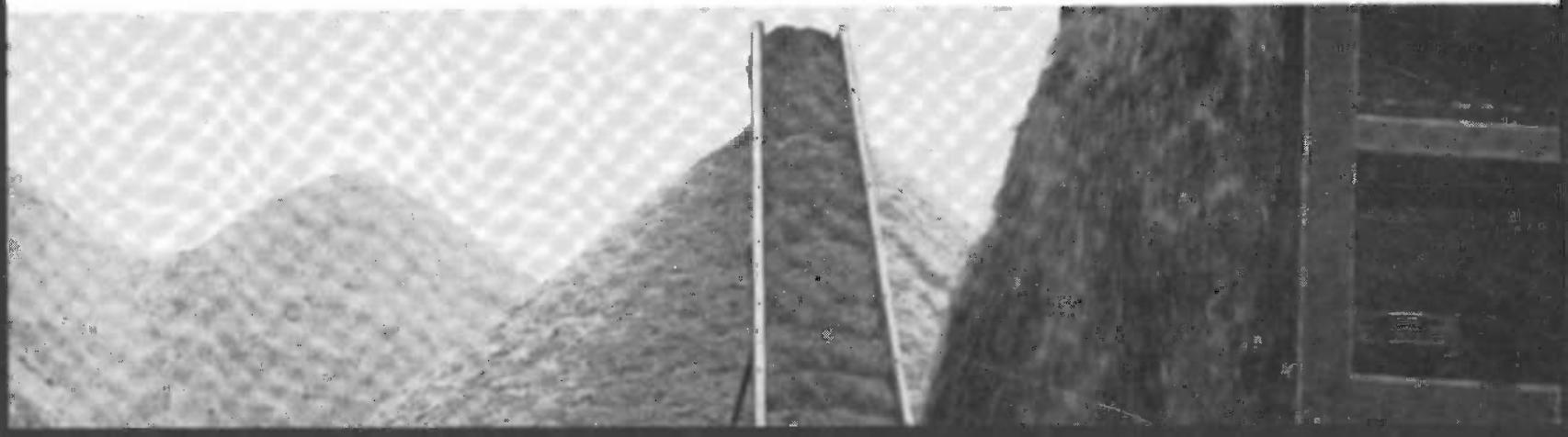


Table 7. Production and Partial Disposition of Residue From Veneer and Plywood Manufacture in Oregon for 1953

Plant location	Production		Residue developed						Disposition of green-veneer trim			Disposition of cores		
	Plywood and veneer	Distribution	Cores	Green-veneer trim	Round-up, log & spur trim	Dry-end residue	Bark	Total	Pulp and fiber	Fuel	Not used	Other uses	Fuel	Not used
	*MM sq ft**	*Per cent*	*M tons‡*	*M tons‡*	*M tons‡*	*M tons‡*	*M tons‡*	*M tons‡*	*M tons‡*	*M tons‡*	*M tons‡*	*M tons‡*	*M tons‡*	*M tons‡*
District 1	330	19	16	44	26	44	42	172	20	15	9	10	3	3
District 2	345	20	17	46	27	46	44	180	28	9	9	13	3	1
District 3	360	21	18	48	28	48	45	187	42	2	4	17	0	1
District 4	303	17	15	41	23	41	38	158	1	10	30	8	2	5
District 5	300	17	15	40	23	40	38	156	0	15	25	10	1	2
District 6†	114	6	5	15	9	15	14	58	0	9	6	5	0	0
All Oregon	1,752	100	86	234	136	234	221	911	91	60	83	63	9	14

* On a ⅜-inch thickness basis.
† Klamath County was included in District 6 for listing of veneer and plywood residues.
‡ Dry-weight basis.

WHAT DO THESE RESULTS MEAN?

Survey results show that there were considerable quantities of unused mill residues in Oregon. These unused residues represent a large potential source of wood raw material that might be termed "residue forests" of the State. Magnitude of this "forest" potential warrants investigation of ways in which it can be used economically. By so doing, output of wood-based products from Oregon can be increased without imposing any additional drain on standing forests.

Future trends in wood-residue utilization

Changes in residue disposition have taken place since the survey was made. Most marked change has been an accelerated trend toward the use of mill residues for pulp and fiber. While 483,000 tons (dry) of wood residue was used for pulp and fiber in 1953, it is estimated that the rate of use of mill residues for pulp and fiber as of September 1955 was 900,000 tons (dry) per year. Thus, use of mill residues for pulp and fiber has increased about 85 per cent in 3 years.

Unused residue

Unused coarse residue in 1953 of 1,759,000 tons (dry) in western Oregon represented raw material with a large potential value. This residue could be converted into over 750,000 tons of pulp. With pulp at $125 a ton, value of pulp produced from this unused residue would amount to over 100 million dollars. This unused residue could support a pulp capacity of 2,400 tons per day. Such a production compares with Oregon's 1955 total pulp capacity of about 2,000 tons per day. Unused coarse residue in eastern Oregon, amounting to 143,000 tons (dry) in 1953, potentially could support pulp production of 200 tons per day.

Douglas fir bark produced in western Oregon amounted to about 2 million tons in 1953. With yields of 7½ per cent tannin and 2 per cent refined wax, 300 million pounds of tannin and 80 million pounds of wax could be produced from bark residue. Large volumes of bast fibers and cork also would be available from bark.

There are, however, many problems in making complete use of residue. Collection of material from many small mills, removal of bark from the wood, and transportation to pulp mills are problems that must be resolved economically before all, or even most, residue can be used.

Pulp and boards

As shown on page 16, most pulp and wood composition board plants were in the northwestern part of the State. Many sawmills and a considerable volume of timber, however, were located in the west-central or southwest part of the State, as shown on page 16. It would be logical for pulp plants to establish where large volumes of wood are concentrated. Such expansion would avoid excessive transportation costs that presently limit use of mill residue for pulp in some sections.

The wood composition board industry was still in its infancy in 1955.

Much lusty, youthful growth of this industry was underway. The first wood composition plant in Oregon started operation in 1930. In 1946, the second plant went into production. Ten years later there were 11 composition board plants in production, with 4 more under construction. Further expansion of this industry undoubtedly will continue.

Pulp and most board processes require bark-free wood. Expansion in use of mill residues for pulp and wood composition boards has furnished incentive for installation of barking equipment at sawmills. In 1951, only 2 sawmills in the State had equipment to remove bark from logs. In 1958 there were about 15 sawmills with barking equipment. Additional installations of barking equipment at sawmills is a virtual certainty. Such installations will make more mill residue available for pulp and fiber uses.

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