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Forest Research Laboratory
School of Forestry
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Corvallis, Oregon

MILL AND WOODS RESIDUES TRIBUTARY TO EUGENE, OREGON AVAILABLE FOR STEAM GENERATION

Robert O. McMahon
Associate Professor of Forest Products Economics

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School of Forestry
Oregon State University
Corvallis, Oregon 97331

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SUMMARY

Hog fuel, 271,897 units (200 cubic feet per unit) almost entirely made up of green bark, is potentially available to the Eugene Water and Electric Board annually for the next 20 years, subject to successful negotiation of long-term supply contracts with 36 companies operating 50 plants within a 45-mile radius of Eugene. "Potentially available" means that the material would have to be bid away from other users, as only a small proportion remains unused at present.

Sawmills would supply 64 percent of the available units, veneer and plywood plants 24 percent, and shake, shingle and chip mills 11 percent.

Failure to negotiate successful contracts, which would most likely hinge on terms of sale, could reduce the total volume available. A few of the 36 companies were skeptical that a satisfactory 20-year contract could be developed.

An undetermined volume in addition to the 271,897 units would be available from 5 of the 36 companies that were unable to specify amounts they would be willing to commit under a 20-year contract.

Twenty-seven companies operating 61 mills declined to consider negotiating 20-year contracts. Several, however, would be willing to sell to EWEB under short-term contracts of one to three years duration, further increasing the annual total of 271,897 units.

Additional volume is likely to be available beyond the 45-mile limit, particularly to the north and south. Some might be obtained economically at much greater distances by backhauling in empty chip trucks.

The value of hog fuel is likely to increase markedly during the next 20 years. Most mill managers intend to sell to the highest bidder.

More than half (9 sawmills and 13 veneer and plywood plants) out of 38 mills within 10 miles of the proposed steam generation plant are interested in purchasing steam.

INTRODUCTION

An explanation of what prompted this study is contained in the letter sent out by Loran Stewart and Ehrman Giustina, a copy of which is included in the Appendix. The primary objective of the study was to estimate the quantity of mill residues (including bark and solid wood) available annually in the Eugene area during the period 1975-1995. A secondary objective was to evaluate the availability of logging residues in the same area for the same period.

MILL RESIDUES

The timing of this study was both fortunate and unfortunate. Interviews to gather needed data on residue availability were made in December 1974 and January 1975. This period may prove, in retrospect, to have been the bottom of the latest market crunch suffered by Oregon's forest industry firms, hence a particularly unpropitious moment to ask company managers to look twenty years into the future, as the study required. Twenty-year projections made from a plateau of prosperity are beclouded enough by normal uncertainties; made from the bottom of a gloomy canyon they are even less prescient.

The industry's traditional resilience and ability to resist adversity, however, were apparent in the responses of many managers. Most expected to resume normal production eventually, and most assumed their companies would survive the next twenty years, though only larger firms could be assured about the latter.

The fortunate consequence of the study's timing was a heightened awareness among all managers that business conditions change with startling rapidity; totally unforeseen factors far outside Oregon and the industry knocked even short-range expectations and plans into a cocked hat in 1974. Thus, though optimism was not totally lacking, and though a substantial number of managers were willing to consider entering into a 20-year agreement, all stressed that factors beyond their control could preclude fulfilling a long-term commitment. Their judgments of the future are, if anything, more realistic and sober now than they might have been at an earlier period.

Data on availability of mill residues were obtained by phone interviews with mill owners or managers. Responses to the interviews, conducted in December 1974 and January 1975 were cordial and informative. Residue volumes for the most part were given by the mills in terms of 200-cubic-foot units of loosely packed hogged material, usually on a daily, weekly, or monthly basis. These responses were extended to an annual basis by applying appropriate operating factors (number of days per year) obtained directly from the mills.

In a few instances volumes were quoted in weight units. These were converted to 200-cubic-foot units with the aid of factors developed by the Forest Research Laboratory at Oregon State University (1, 2).

As interviews were conducted during a period of reduced or even suspended operations, the volume data were mill estimates of what would be available during the ensuing 20 years under "normal" operating conditions.

Number and Location of Mills

A 45-mile airline radius from Eugene was selected as defining the study boundary within which a 100 percent mill canvass was attempted. Forty-five miles was arbitrarily selected to represent a reasonable maximum for hauling residues under current conditions and to limit the number of mills to be contacted to manageable proportions within the time available to conduct the study. Subsequent discussions with some mill managers revealed that the 45-mile limit, if anything, was too low for today's practices.

The area covered by the study is shown in Figure 1. The three concentric rings are at air distances of 10, 25, and 45 miles from Eugene, each ring divided into zones denoting distance and direction of available mill residues as shown in Table 1. A segment in the northwest quadrant was omitted because few mills are located there, and the roundabout highway distance to Eugene is long.

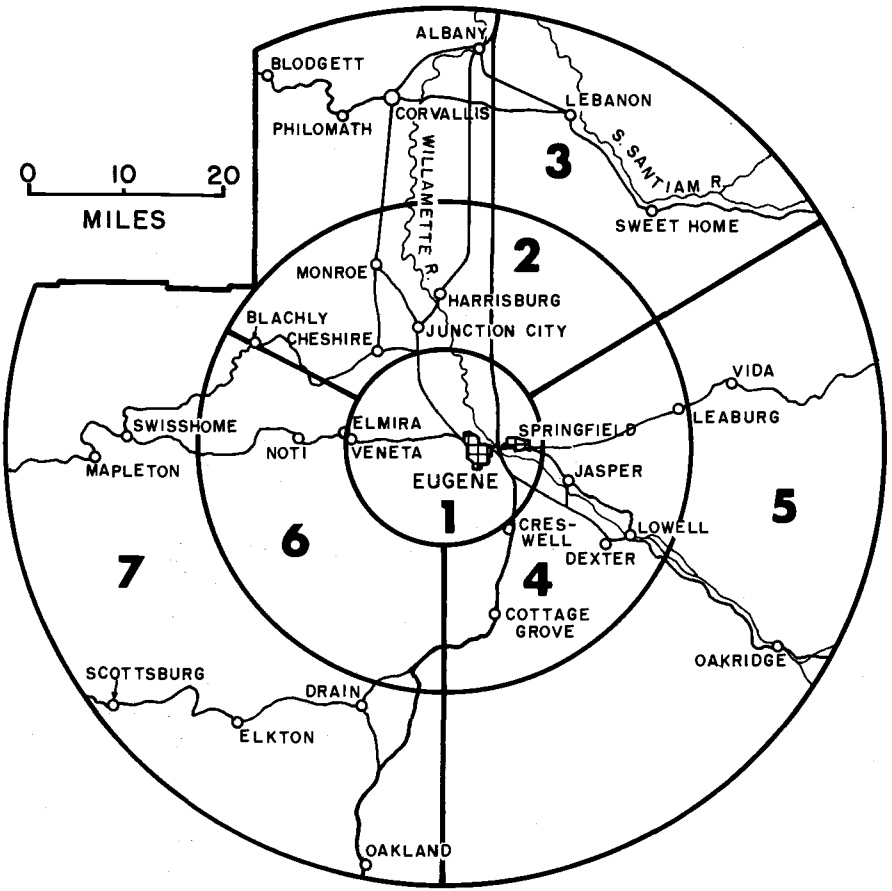

Figure 1. The area surrounding Eugene included in the study. Concentric rings show air distances of 10, 25, and 45 miles from center.

When the interviews were finished, 65 companies with a total of 117 mills had been contacted (Table 2). At the beginning of the project there were believed to be 122 mills within the study area. Because 3 mills were not operating, another 3 were dismantled and 5 small shingle mills were not reached, 111 mills operated by 63 companies remained potential residue suppliers for the purpose of this study.

Table 1. Description of Zones[1] that Subdivide the Area Studied.

Zone	Description
1	Within 10 miles of Eugene
2	From 10 to 25 miles north of Eugene within the Willamette Valley
3	From 25 to 45 miles north of Eugene within the Willamette Valley
4	From 10 to 25 miles east and south of Eugene within the Coast and Middle Fork drainages of the Willamette River
5	From 25 to 45 miles east and south of Eugene within the Coast and Middle Fork drainages of the Willamette River
6	From 10 to 25 miles west of Eugene
7	From 25 to 45 miles west of Eugene

[1]The zones and their boundaries are outlined on the map in Figure 1.

Companies Willing to Supply Fuel

Among the 63 companies, 36 of them, operating 50 plants, were willing to discuss details of the 20-year option agreement sought by the Eugene Water and Electric Board to assure a sufficient fuel supply for its proposed facility for steam generation. A few of these firms, although willing to attempt to negotiate an agreement, were skeptical that an arrangement reasonable and equitable to both sides could be worked out. The remainder, for the most part, thought that concluding a satisfactory agreement should not present insurmountable problems.

Twenty-seven companies that declined to make residues available to EWEB had acceptable outlets for all their residue material, could not foresee having a surplus beyond their anticipated needs during the 20-year period, or were unwilling to enter into a commitment of that length.

Table 2. Number, Zone, and Type of Mills Represented in Interviews, January 1975.

Mill	Zone[1]							
	1	2	3	4	5	6	7	All
Sawmills								
80 M^2 or larger	13	2	7	5	3	1	4	35
Less than 80 M^2	8	2	9	3	-	1	2	25
Subtotal	21	4	16	8	3	2	6	60
Veneer and Plywood	19	2	14	4	3	2	3	47
Other[3]	5	-	3	1	1	-	-	10
All	45	6	33	13	7	4	9	117

[1]Zone numbers correspond to numbered map segments in Figure 1.
[2]Sawmill size in terms of thousand board foot capacity per 8-hour shift.
[3]"Other" includes shake, shingle, and chip mills.

Table 3. Location of Mills Willing to Consider Long-Term Contracts, and Their Annually Available Hog-Fuel Volumes, January 1975.

Zone	Number of mills	Annual unit volume
	DIRECTION FROM EUGENE	
Central 10 miles (Zone 1)[1]	26	109,236
North 10-45 miles (Zones 2, 3)[1]	13	72,786
East and south 10-45 miles (Zones 4, 5)[1]	7	60,875
West 10-45 miles (Zones 6, 7)[1]	4	29,000
Total	50	271,897
	DISTANCE FROM EUGENE	
Less than 10 miles (Zone 1)[1]	26	109,236
10-25 miles (Zones 2, 4, 6)[1]	7	48,105
More than 25 miles (Zones 3, 5, 7)[1]	17	114,556
Total	50	271,897

[1]Zone numbers correspond to numbered map segments in Figure 1.

Several of the latter were willing to sell on a yearly basis or would consider short-term contracts for 2 years or so. These might add a cushion under the volume available under long-term contracts.

Of the 36 companies willing to attempt to negotiate 20-year contracts, 5 were unable to specify at this time what volume of material they would commit to the arrangement. These also might add volume to that reported available. On the other hand, some companies willing to attempt an agreement might subsequently find the terms unacceptable, which would cause the totals in Table 3 to be optimistic. The extent to which these possibilities would offset each other cannot be estimated but should at least be considered.

Volume, Location, and Character of Available Fuel

The 271,897 units of material shown in Table 3 are comprised almost entirely of bark. The question posed to mill managers concerned burnable material, hogged or not, so as to tap the maximum volume of available fuel. That very little wood residue was offered reflects a conviction among mill managers that clean wood fiber, whether in the form of chips, sawdust, or shavings, has, or soon will have, uses of higher value than fuel. Although practically all bark is now hogged, several managers would prefer not to operate their own hogs.

"Willing" mills and their available volume of hog fuel are shown in Tables 3 and 4. Table 3 emphasizes the small volume found in the intermediate ring, 10-25 miles from Eugene (zones 2, 4, and 6). Most (87 percent) of the 48,105 units shown there is concentrated in zone 4 at 4 mills.

Table 4. Type and Number of Mills Willing to Consider Long-Term Contracts and Their Annually Available Hog Fuel Volumes, January 1975.

Type of mill	Interested	Volume per year in units	Not interested
Sawmills			
80 M[1] per day or more	15	129,611	19
Less than 80 M[1] per day	12	45,455	10
Subtotal	27	175,066	29
Veneer and Plywood	15	67,243	30
Other[2]	8	29,588	2
Total	50	271,897	61

[1]Sawmill size classes are in terms of thousand board foot capacity per 8-hour shift.
[2]"Other" includes shake, shingle, and chip mills.

Similarly, of the 114,556 units in the outer ring (zones 3, 5, and 7), 58 percent is located in zone 3 at 11 mills and another 25 percent in zone 7 at 3 mills. Table 4 reveals that sawmills are the primary source of available hog fuel; the largest size class alone accounts for nearly half (47 percent) of the total.

Only a small proportion of the potentially available 271,897 units is unused, that is, dumped or burned. Most of the volume is currently sold or given away, confirming results of an earlier survey by Schuldt and Howard (7), who found that over 90 percent of bark residues were used in essentially the same area as covered by the present study. In some instances, managers confirmed that their volume would have to be bid away from other users. In other instances, the available volume was surplus to other uses; the manager intended to continue supplying present outlets. In all interviews there were strong indications that "available" meant an amount that would be offered to the highest bidder at prices determined at least annually and as often as quarterly if prices are changing rapidly.

Additional primary wood processing plants are located in communities in the Willamette Valley lying just outside the 45-mile perimeter on the north. The same is true in the south—the point being that additional residue might be available from both directions. An organized residue delivery system would probably find it worthwhile to extend collections beyond the arbitrary 45-mile limit of this study.

Moreover, much longer hauling distances might be made economical by using now empty backhauls of chip trucks to bring residues from outlying areas. Further exploration of this potentiality would be warranted if the new steam generation plant appears feasible. Residues obtained on a backhaul, if lower in cost, could substitute for more expensive nearby material.

Interest in Purchasing Steam

Only those mills in zone 1 were considered potential customers for steam from EWEB's proposed new facility, and probably most of those on the outer fringe of the 10-mile limit of this zone are beyond economical reach. Table 5 shows the relation between the interest in steam and interest in a 20-year contract. Interest in steam, by type of mill, also is shown. Shake, shingle, and chip mills are not included because they do not use steam. As there are 38 operating mills in total in zone 1, more than half (22) are potential customers.

Table 5. Mills Interested in Purchasing Steam and the Relation Between Interest in Purchase and a Twenty-Year Contract.

Item	Purchasing steam	
	Interested	Not interested
MILL TYPE		
Sawmills	9	10
Veneer and plywood	13	6
20-YEAR CONTRACT		
Favor	18	5
Do not favor	4	11

Availability During the Next 20 Years

The question of critical importance to EWEB, whether the volumes reported potentially available now will continue to be available throughout the 20-year period, cannot be answered easily. Various techniques could have been employed to project probable levels of residue production and use during the next 20 years. Such projections, however, would have to rest heavily on assumptions concerning timber supplies, number and characteristics of mills, technological changes in production processes, price levels and relationships among residue fractions, and ultimate uses of the different types of residues. The result would be a set of numbers that could be misleading; close analysis would suggest placing little confidence in such absolute numbers because of the uncertainty attaching to the assumptions. Changes in any of the basic assumptions could cause substantial shifts in final estimates.

An alternative to projecting availability of hog fuel was adopted for the study and is in the data presented in Table 3. Mill managers were asked to estimate the volume of material they would be willing to commit to a 20-year arrangement with EWEB under normal operating conditions now. The managers should be in a strong position to evaluate assumptions about their operations for the next 20 years and to evaluate uncertainties that might prevent them from fulfilling a long-term contract. By indicating the volumes they were reasonably confident of supplying on a continuing basis, they in effect assumed the problem of making a 20-year projection. Those who were too uncertain about future conditions and residue use declined to consider negotiating a contract; no volumes are shown from such sources in Table 3.

The one trend visible today that is apt to change hog fuel availability during the next 20 years is the escalating cost of energy. Consequences of this trend surfaced in the interviews when managers revealed they already had converted, were converting, or were seriously contemplating converting boilers to hog fuel to reduce dependence on oil or natural gas. This was a primary reason why 27 companies were unwilling to commit themselves to a 20-year contract.

Although managers representing 27 sawmills were interested in discussing details of the contract, managers of 29 were not. Among the largest sawmill size-group (120 thousand or more board feet per 8-hour shift) only 7 of 22 mills were interested; 15 were not. Among veneer and plywood plants, only one-third (15 of 45 plants) were interested in the contract. This may reflect the importance and increasing cost of energy in the production of plywood.

Other factors that would decrease the availability of hog fuel in the study area are a decrease in the volume of timber processed in the area, barking of logs in the woods, and increased use of bark for particleboard furnish and for wax extraction. None of these is expected to have an appreciable impact, however, during the next 20 years. No major change is foreseen in the volume

of timber harvested on federal government and forest industry lands. As the value of hog fuel increases, the likelihood of barking in the woods will diminish. Use of bark for particleboard furnish and wax extraction, although likely to increase somewhat, is not expected seriously to lessen hog fuel availability to EWEB during the contract period. Hog fuel value for energy generation, if oil and gas costs remain at present levels or rise further, could result in bark being bid away from particleboard use.

WOODS RESIDUES

According to some recent studies by Grantham and others (3, 5, 4), the potential of woods residues as an additional fuel source for generating energy is not particularly promising. The viewpoint of those studies, however, may not be entirely appropriate to the special situation EWEB is confronting. Grantham was investigating the possibility of large-scale generation of electrical energy with woods residues as the primary fuel source, and he has presented a convincing case for the negative.

EWEB, however, would have only to regard woods residue as a secondary fuel source after mill hog fuel was exhausted. The difficulty of obtaining large volumes of material on a continuing basis, a characteristic of the problem Grantham was addressing, would not exist for EWEB. But the difficulties of gathering and transporting material would apply, and EWEB would have to evaluate the costs of obtaining this type of fuel against alternative sources such as urban wastes and coal.

To meet EWEB's target volume of 300 thousand units of hog fuel annually, less than 50 thousand units of woods residues probably would be required to round out the estimated 272 thousand units available from mills in the area, allowing for shrinkage in the latter figure caused by companies finding terms of the 20-year contract unacceptable.

In examining volume and characteristics of logging residue, Howard (6) found the total usable for fuel on national forests, after deducting chippable volumes, to be over twice that on other public lands and nearly nine times that on private lands in the Douglas-fir region. Reasons for this are age and characteristics of timber, topography, and small economic incentive on national forest timber sales for buyers to practice clean logging. National forests, therefore, should be the first choice as a source for logging residue.

Grantham (3) presents data derived from Howard (6) indicating the relation of logging residue weight to log volume harvested on national forest clearcuttings in the Douglas-fir region. He states that the difference between gross and net weights of residue is the amount available for fuel, assuming all residues are brought out of the woods. Whether his fuel fraction includes or excludes 10 percent for bark is unclear. But irrespective of whether bark is included, the important point is the substantial amount of residue generated in logging on national forests. Application of his factors to the 834,847,000 board feet of timber cut on national forests in Lane County in 1973 yields the figures in Table 6.

Table 6. Bone-dry Tons of Residue from Timber Cut on National Forests in Lane County in 1973.

Minimum length of piece	Factor	Weight of fuel
8 feet	0.30	250,454 tons
12 feet	.25	208,712 tons
20 feet	.15	125,227 tons

How much of this material might be available to EWEB remains unanswered. Perhaps the biggest hurdle to overcome is the devising of a sale procedure with the U.S. Forest Service. Another problem would be how to get material to the point of use at reasonable cost. Grantham *et al.* (5) suggest that delivered costs would be quite high—$30 to $40 per dry ton.

A corollary issue is how much volume might continue to be produced annually. Grantham's factors apply to 1969 conditions. Though the volume of timber to be cut on national forests in Lane County during the next 20 years is expected to remain fairly steady, the amount of potential fuel left as residue might decline. The escalating value of stumpage since 1969 has contributed to more careful logging practices and to removing more material from the sale area. Companies dependent on national forest timber and having hog-fuel-fired boilers will have additional incentive to clean-log their sales. Grantham (3) suggests that advances in materials-handling techniques will make increased removal of residue feasible. He also points out that improved production technology, spurred on by high costs of raw material, permits increased recovery of higher value primary products, and will tend to reduce mill residues. This in turn will cause residue users, mainly pulp and board producers, to shift to logging residues for their raw material. They will likely be able to bid higher prices for it, because of higher end-product values, than could a company using it for fuel only.

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APPENDIX

LETTERS SENT TO MILLS EXPLAINING THE STUDY

Before phone contact, Loran Stewart of Bohemia Inc. and Ehrman Giustina of Giustina Bros. Lumber & Plywood Company sent a joint letter to each mill within the 45-mile radius to explain the nature and purpose of the study and to request cooperation of the recipients. A followup letter from the project director, R. O. McMahon of the School of Forestry at Oregon State University, indicated the kind of information that would be sought in subsequent interviews. Copies of both letters shown here were sent to companies operating sawmills, veneer and plywood plants, or shake and shingle mills in the project area.

Dear Mr. ——:

As part of the effort to clean up this part of Oregon, we are interested in the possibility of solid waste disposal in the generation of steam and electricity. This requires supplementary fuels. Oil and gas prices put them out of reach. Coal appears marginal at best. *Residues from the forest industries are another possibility.*

On our recommendation, the Eugene Water and Electric Board has contracted with the Forest Research Laboratory, Oregon State University, to estimate the volume of mill and woods residues available to supply part of the fuel for a new steam generation plant in Eugene.

You may have been contacted one or more times in the past couple of years by others doing research into the Western Oregon wood waste situation, perhaps on behalf of EWEB. We don't intend to re-do the work of others or cast doubts on the accuracy of that work, but rather to update the necessary information inasmuch as our industry has undergone substantial changes in recent times. We also believe it is most important that the fact-finding effort this time place heavy emphasis on learning what may happen during the next ten years or so in the way of further change that would have a bearing on the types and availability of wood by-products for uses such as are contemplated by EWEB.

In the near future Bob McMahon, representing the Laboratory, will be contacting you to discuss the possibility of EWEB obtaining a first option arrangement each year to purchase some of your burnable residues, at the going market price.

We strongly support this study and ask your cooperation with the Laboratory in carrying it out. If you should have any questions, please feel free to contact one of us, either by phone or in writing.

Ehrman Giustina
Giustina Bros. Lumber & Plywood Company
P.O. Box 989
Eugene, OR 97401
Phone: 345-2301

L. L. Stewart
Bohemia Inc.
P.O. Box 1819
Eugene, OR 97401
Phone: 342-6262

cc: Mr. Bob McMahon

Dear Mr. ——:

Recently Loran Stewart and Ehrman Guistina wrote to you about using wood and bark residues as a fuel supply for a steam generation plant in Eugene. All mills within a 45-mile radius of Eugene were contacted as potential suppliers. As mentioned in their letter, I would like to visit with you about residue utilization and the possibility of your operation providing some of the needed fuel.

The main questions I want to raise are these:

1. Would your company be interested in negotiating an *annual* arrangement with the Eugene Water and Electric Board during each of the next 20 years, giving EWEB a first option to purchase up to a maximum specified quantity of wood or bark residues at a mutually acceptable price?

2. If interested in an option arrangement, what fraction of your company's residues would be available to EWEB, specified in terms of plant location and type of material?

3. If any of your mills are within approximately 10 miles of the Eugene plant-site, would your company be interested in purchasing steam from EWEB, either outright or in return for residues?

Within the next two weeks I will phone for an appointment to discuss these questions with you.

Sincerely,

Robert O. McMahon
Associate Professor

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