A typical pre-logged area on the Weyerhaeuser Timber Co.'s holdings at Vail, Washington. Residual stand is old growth Douglas fir, which will be removed as sawlogs in subsequent harvest.
THE POSSIBILITIES OF PRELOGGING FOR CLOSER WOODS UTILIZATION IN THE DOUGLAS FIR REGION OF THE PACIFIC NORTHWEST

By

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Professor of Forestry
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I especially want to acknowledge the assistance of the following in acquiring data:

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</table>
INTRODUCTION

Definition

A definition of prelogging was aptly stated by E. P. Stamm of the Crown Zellerbach Corporation in his address to the Western Forestry and Conservation Association. It was explained as the advanced harvesting of dead, dying, deformed and suppressed trees for salvage purposes; and the cutting of poles, pilings, and saplings in overstocked areas in order to get accelerated growth on the remaining trees.1

The Problem

The utilization of so-called inferior species and the small, suppressed and deformed trees of the superior species has always been a logging problem in America. Not only does the greater accumulation of slash present a great fire hazard and therefore a hazard to adjacent timber supplies, but there is an actual loss of the potential volume that can be realized from the stand.

This fact has been brought out in actual measurements of stands in southwestern Washington by Vincent W. Bousquet, Branch Forester at the Vail-McDonald operations of the Weyerhaeuser Timber Company. These measurements showed that fifty-year-old stands of Douglas fir (Pseudotsuga taxifolia) growing on sites of average to medium good production will yield fifteen to twenty cords of pulpwood per acre which amounts to sixteen percent of the cubic foot volume of the stand. Seventy-year-old

1Stamm, E. P., "Developments in Relogging and Prelogging", presented before the 37th Annual Meeting of the Western Forestry and Conservation Association.
stands will yield about forty cords or more per acre containing approximately twenty percent of the total volume in cubic feet.2

This volume was lost because of the following reasons:3

1. There were no satisfactory market conditions for the utilization of inferior species, thinnings, or deformed trees.
2. Special handling methods would have to be devised because of the variable size, species, and volume per acre.
3. Extensive road systems would have to be built over rough terrain at great cost.

These reasons can all be summed up in one sentence. It just was not economical for the private owner to transport these trees to the mill.

A use has been found, since and during the recent war, for the so-called inferior species in the pulp, paper, and fibre board products. Western hemlock (Tsuga heterophylla) was one of the inferior species up until now. However, it is now recognized as one of the prized species of pulpwood because of its superior fiber quality.4 The true firs (Abies sp.) are other species that have been utilized for pulp in the last decade.

The two most important factors contributing to the recent wood utilization program are probably, first, the high degree of development in the pulp and wood chemical industries; and second, the high prices that the inferior species and low grades of superior species are now bringing. The problem now, is to find the most economical method of logging and utilizing these once-inferior products, and the dying and deformed trees.

2Bousquet, Vincent W., "Practical Possibilities in the Management of Second Growth with Special Reference to Production of Pulp", at the 37th Annual Meeting of the Western Forestry and Conservation Association.

3Stamm, E. P., loc. cit.

The utilization program has taken the form of three distinct phases.

1. A prelogging of the area to harvest all suppressed, deformed, and diseased trees.

2. The use of closer utilization of trees during the main harvest.

3. Finally a salvage operation to recover all of the logging debris after the main harvest.

Prelogging is not a new practice, but by changing the idea behind it, this operation can be made very useful. In the early days, only the high-value trees such as alder (*Alnus* sp.) and maple (*Acer* sp.) for furniture and cedar (*Thuja* sp.) for poles were taken. Now, it is the suppressed, diseased, and deformed trees that are being taken out before the main cut.

It is the object of this paper to discuss and present the developments and progress of this first phase of closer woods utilization.
THE LOGGING METHODS

Falling and Bucking

**Damage:** The stumps that are left in prelogging have been found to be quite a problem. The breakage of the timber on the second cut due to these stumps has been a definite factor against prelogging, especially in what would be termed thinnings. This problem is being worked out at the Vail-McDonald Tree Farm of the Weyerhaeuser Timber Company and the Clatsop County Tree Farm of the Crown Zellerbach Corporation. Different methods of falling are being tried so as to obtain the shortest possible stump. The Crown Zellerbach Corporation has been able to cut to six- and eight-inch stumps.

**Falling:** At the Vail-McDonald Operation the falling crew is made up of one man. His equipment consists of a one-man hand or power saw, an axe, bottle of oil, small sledge and wedges, and a file. Hemlock, from six to sixteen inches in diameter at breast height, along with cedar is cut.5

The Crown Zellerbach Corporation uses a two-man falling crew. This crew uses a one-man power saw with a thirty-inch blade. The Chief Forester for the Columbia River District, Mr. Clarence Richen, stated that this method was used so as to get the shortest stump possible. Also, timber is taken from twelve to thirty inches in diameter. This might be a factor for the use of a two-man crew instead of a one-man crew as Weyerhaeuser uses.

5"Three-Time Forest Harvest", loc. cit.
At the Molalla operation of Pope and Talbot the falling is done by contract work. The company furnishes the falling and bucking tools, including a power saw.

It might be well to state here that in the Weyerhaeuser operation at Vail the prelogging is mostly concerned with thinning out suppressed hemlock, fir, and cedar of small diameter, while both the Crown Zellerbach operation at the Clatsop County Tree Farm and the Pope and Talbot operation at Molalla are mostly concerned with the salvaging of the older and defective trees. Consequently, the methods and costs will vary.

Figure 1

Hand falling at Vail

**Bucking:** At the Vail-McDonald operation the bucker bucks the tree into forty-foot logs down to a four inch top. It is assumed from

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6"Three-Time Forest Harvest", loc. cit.
information gathered from the other operations that the log lengths run from thirty-two to forty feet. Both hand and power saws are used, the power saw being the more efficient.

Cost: The falling and bucking costs are still high and are one of the main sources of trouble. The fact that the fallers must cover so much ground is the main reason.

Floyd S. Blackburn of Pope and Talbot states that their falling and bucking costs are around $6.50 per thousand board measure. However, by furnishing the tools and a power saw this cost can be cut down to $5.00 per thousand board measure.

Crown Zellerbach gives a cost of $2.50 to $5.50 per thousand with an average of $3.50 per thousand. These costs will, of course, vary with the terrain, the efficiency of the crews, and the volume per acre.

If the average two-man crew could fall fifty thousand per day at $35.00 per day, this would give an approximate cost of $1.70 per thousand. Assuming the same production and pay for the bucking crew, this would give a total of around $3.40 per thousand board measure.

By averaging these three different sources of cost data we might have a fair picture of the falling and bucking costs.

<table>
<thead>
<tr>
<th>Source</th>
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<tr>
<td>Pope and Talbot</td>
<td>$6.00</td>
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<tr>
<td>Crown Zellerbach</td>
<td>3.50 (average)</td>
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<tr>
<td>Author's Assumption</td>
<td>3.40</td>
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<tr>
<td>Average</td>
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Yarding

Yarding has been one of the major problems in prelogging and many different machines have been used. They range from a small high lead to the use of horses. The costs here, as in all the operations are high because of the mobility of the equipment needed to cover the ground. The
more important methods used shall be considered here.

**Portable tower:** The spar pole of this yarding system is usually a portable tower powered by a triple or double drum tractor.

A forty-foot steel tower, mounted on a set of logging arch tracks is used as the portable spar pole at the Vail operation. The tower is a discarded shovel boom, which can be lowered when the yarding unit is moved to another setting. The tower is rigged with a block on each side and is secured in position by four guy lines.7

![Portable Tower used by Weyerhaeuser](image)

The power is applied from a triple drum take-off from a D-8 "Caterpillar". A 3/4-inch main line and a 1/2- to 5/8-inch haulback are generally necessary.8

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7"Three-Time Harvest", loc. cit.

8Bousquet, Vincent W., loc. cit.
The existing primary roads are used and the forty-foot logs are yarded to the roadside where they are bunched for loading. The yarding distance is 400 feet at each setting. The tractor is backed off from the tower to provide clearance for the main line and haulback, and is able to maneuver around for best power direction. Two men work at the yarding landing.9 There would also have to be the choker setter and the rigging slinger if this included the machine operator and unloader.

The Crown Zellerbach Corporation has perfected a fifty-five foot tractor-mounted tower for use in its Clatsop County operations. The maximum yarding distance is 500 to 600 feet, but because of its flexibility the distance is usually kept down to 300 to 400 feet.10

This machine is readily moved over tractor roads and has self-tightening guy lines. By the use of these it can be moved and re-rigged in from one to two hours. Each guy line is attached to a separate drum near the base of the tower where power is supplied to any drum from an auxiliary gasoline engine. A 7/8-inch main line, a 5/8-inch haulback, and 3/4-inch chokers are used.11

For highest efficiency a six-man crew is needed. This includes two choker setters, the machine operator, chaser, unloader, and rigging slinger. The rigging slinger chooses the new settings to coordinate decking and swinging, and supervises selection of salvage material.12

The yarding costs will vary from $3.00 to $5.00 per thousand depending on differences in terrain, efficiency of crews, and yields per acre. The yarding costs are approximately five times that of the loading

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9"Three-Time Forest Harvest", loc. cit.
10Stamm, E. P., loc. cit.
11"Re-logging Machines and Methods", Timberman, Sept. 1947, pp. 46-48
12Ibid
costs, since a loading crew can load out logs about five times as fast as the yarding crew can yard them out.

**Tractors:** Tractors of all types are being used ranging from 55-horsepower to 113-horsepower diesels. The most common practice is to use the smaller tractors without arches.\(^\text{13}\)

The Crown Zellerbach Corporation employs the use of a "bunching tractor". The unit consists of an old 75 "Caterpillar" with an eleven-foot A-frame attached to the rear end. A single 5/8-inch yarding line with

\(^{13}\text{"Relogging Machines and Methods", op. cit., pg. 46.} \)
Bunching Tractor: One of two types used by Crown Zellerbach for bunching small and salvage logs. This type has 21-foot frame, other type employs an A-frame. Very efficient.

A flat hook on the end is carried on the free-spooling haulback drum and the line is pulled out by hand. The average yarding distance is 100 feet. As much as 80,000 feet of logs have been yarded in a day with a four-man crew. There is also a "bunching tractor" with a 21-foot frame that is used.14

Pope and Talbot use a double drum tractor in yarding, and find that it costs about $3.75 per thousand.

Miscellaneous: Small high lead units have been used in prelogging, but are much more extensively used in re-logging. Here the spar tree is used for both yarding and loading. Most of the machines have been converted loaders powered by 85-horsepower and 100-horsepower gasoline engines. The yarding distance should be limited to 500 to 600 feet, although distances have ranged up to 1200 feet.

The Comox Logging and Railroad Company, Limited, at Ladysmith, British Columbia developed one of the first yarding units for salvaging logging waste. Because of its mobility it could certainly be used in

14Ibid, p. 47
prelogging operations. The "Peanut Picker" consists of a 28-foot A-frame, drums, and engine mounted on an old five-ton truck. A 9/16-inch main line

Figure 5

"Peanut Picker"

and a 5/16-inch haulback were used with an average yarding distance of 260 feet. The costs were found to be lower than using a light yarding machine with the original spar pole and an external yarding distance of 590 feet. A three-man crew is used with the "peanut picker".15

Horses have been tried for yarding and have been found to be quite effective.

Loading

Shovel-type loaders have been found to be the most popular because of their flexibility, especially in handling small logs. In the salvaging of the larger-sized logs in the stand, loading systems such as crotch lines, McLean booms, and cross haul are used.16

15"Re-logging Machines and Methods", loc. cit.
16Ibid, p. 46
Shovel-Type Loader: At their Vail-McDonald operations, Weyerhaeuser uses a converted 3/4-yard Lima shovel with a single tong hook. The cold-decked hemlock are loaded singularly onto the logging truck trailer by a three-man crew. The "Shovel" operator, loader, and unloader make up this crew. The costs probably range from $0.60 to $0.80 per thousand, being approximately one-fifth of the yarding costs.

Figure 6

Loader at Vail prelogging operations

Both the Crown Zellerbach Corporation and Pope and Talbot use shovel loaders of this type in their prelogging operations. At Molalla, Pope and Talbot found their loading costs averaged $0.50 per thousand. The lower costs here are probably due to the larger size of the timber that was handled.

The shovel-type loader has also been used for yarding, but has not been successful in this capacity as they cannot reach out far enough.

17"Three-Time Forest Harvest", loc. cit.
Boom on Small Shovel: The Puget Sound Pulp and Timber Company uses a small shovel with a boom on their relogging operations.\(^{18}\) It seems this could certainly be put to use in prelogging operations. The initial cost would not be as great for the small operator as with the Lima shovel, and it could also be used for yarding short distances.

Cable Loading Systems: Pope and Talbot use the crotch line loading system at Molalla when logging with tractors. This is because of the mud in the winter and log piling room in the summer. They find that

\(^{18}\)"Re-logging Machines and Methods", loc. cit.
the more room they have on the rollway for storing logs the better, for they can get along with less log trucks, and can haul the extra logs when moving to a new rollway. They find the costs of this system to be a little higher than with the shovel-type loader - $.70 per thousand.

When using a small high lead in yarding the McLean boom is usually the system that would be used in conjunction with it. Most of the other standard cable systems are in use, and cost probably varies from $.50 to $.80 per thousand.

**Preloading**

Since the smaller logs are usually bundled by steel strapping to keep sinkers afloat, some method had to be devised to strap the logs together before loading them on the railroad cars or dumping them into the river.

The Crown Zellerbach Corporation devised such a special preloading machine at their Neah Bay, Washington operation. The unit consists of a steel bed on which is mounted two sets of cradle-like semi-circular jaws

**Figure 9**

Crown's Preloader

in upright position. The logs are loaded into the open jaws, bundled and strapped, and then lifted by crane onto the truck. Four loads such as
these make a truck load. Although this method of bundling has been quite satisfactory, there seem to be too many re-handlings. There have been no estimates as to the costs of preloading.

The Weyerhaeuser Timber Company seems not to have devised any such preloading system. They strap the logs together when the truck is waiting to be unloaded at the re-load station.

Major Transportation

Strapping of Bundles: Another of the main troubles in handling the small hemlock logs was the fact that some would sink when dumped in the river for rafting. By strapping the logs into bundles these "sinkers" were kept afloat.

At the Vail operation, three steel bands, two inches wide and .005 of an inch thick, are being used and are held together by Acme clips.

Figure 10

Clamping of Bands on Packaged Hemlock

19"Re-logging Machines and Methods", loc. cit.
However, just lately they have started using four straps. Experience showed that certain band failures occurred when the loads were dumped in

Figure 11

Vincent Bousquet checking bands on load of small hemlock from Vail the bay. The addition of the extra strap, with few exceptions, eliminated the trouble.

Figure 12

Packaged hemlock ready to be rafted
The Crown Zellerbach Corporation uses three steel straps, two inches wide and 1/16-inch thick, held together by a patented crimped sleeve. These straps are re-used once, and the strapping costs were estimated at about $.20 per thousand. Clarence Richen, Chief Forester for the Crown Zellerbach Corporation said that they are experimenting with a wire rope strap with a 1/2-inch hook. This is being tried so as to eliminate the discarding of the straps after the second use. Mr. Richen also mentioned the use of #3 galvanized wire for bundlings but stated that the steel strap has been found to be the most acceptable.

Trucking: The addition of stakes has been the only adaptation to the conventional type trucking equipment. These facilitate the handling of small diameter and random-length logs.20 At the Vail-McDonald operation the trucking is done in conjunction with railroading and rafting. The average truck load is 6.5 cords with a 100-cubic-foot cord based on the Sorenson log scale, or 3250 board feet.

Figure 13

Truck load of prelogged hemlock showing bunk stakes

20"Re-logging Machines and Methods", loc. cit.
Scribner log scale. The average number of logs per cord is five. After the trucks arrive at the re-load station, the load is bundled and swung onto the railroad cars. Since the primary road system is used there is no cost for construction of roads, but there is, however, an added cost of maintenance.

The truck hauling costs at the Molalla operations of Pope and Talbot run $5.00 per thousand for a twenty-two mile haul; this will make a cost of $.227 per thousand per mile. The operation is planning to purchase their own trucks, and figure that they can save up to thirty percent on transportation. The maintenance cost is $.05 per thousand per mile, and what spur roads are constructed cost $1.25 per thousand.

Railroading: The Weyerhaeuser Timber Company uses the same railroad re-load station for the small logs as it does for the larger logs of the primary cut. The small hemlock then becomes part of the regular log train. The packaged unit is then hauled to the log dump near Olympia, dumped into the water, and then made into rafts.21

RAFTING: There is little difficulty in rafting, now that the use of bundling has been perfected. The bundled logs are rafted right along with the large logs. The straps are retrieved at the mill and sent back for re-use. The towing charge is around $.01 to $.02 per thousand per mile. The standard rafts are constructed, and no special shaped raft is used for the prelogged hemlock.

21"Three-Time Forest Harvest", loc. cit.
Ready to go to the water dump by rail. The big sawlogs, result of the primary sawlog harvest, are at the left. The prelogged hemlock load is at the right, bound with wire straps.
THE PRODUCTS

Sawlogs

Sawlogs salvaged in prelogging operations can bring in the highest return of any of the other products. Douglas fir (Pseudotsuga taxifolia) and Western hemlock (Tsuga heterophylla) can both find ready markets as sawlogs, and on the open market bring as high as thirty to forty dollars per thousand. It is from the returns on these larger-sized sawlogs that the costs of the prelogging operations are usually paid. Since the costs per thousand vary inversely with the size of the logs, it can readily be seen that the greatest returns per thousand can be made from the larger salvaged products.

The Crown Zellerbach Corporation cut 17,000 acres in Clatsop County during the period from 1929 to 1941 to salvage a substantial quantity of large over-mature spruce. This was done so as to salvage the losses that would have otherwise been incurred if the logging of these trees had been delayed until the routine clear-cut schedule.

If there are any furniture factories nearby, they can furnish possible markets for both maple and alder. These hardwoods, of course, would have to be in substantial quantities so as to be profitable to the contractors. Mr. Boyd Rasmussen, in charge of timber sales in the Mary's Peak vicinity, quotes Forest Service stumpage prices of alder (Alnus rubra) ranging from $2.50 to $4.00 per thousand, depending on the topography, length of haul, and the stumpage per acre. If maple were in

22Stamm, E. P., loc. cit.
substantial quantities it could probably bring greater stumpage prices than alder.

**Pulpwood**

The Weyerhaeuser Timber Company and the Crown Zellerbach Corporation seem to be the only concerns that are prelogging small hemlock. The yield per acre at the Vail operation has averaged 11.2 cords on a 100-cubic-foot per cord basis. At fifteen cents per cubic foot this would be fifteen dollars per cord, or $168.00 per acre delivered to the mill.

Of course, to salvage these suppressed hemlock there must be a pulp mill close enough so as to make the prelogging operation feasible. This is probably the main reason why other operators are not taking out the smaller hemlock.

**Cedar**

The cedar poles can probably bring in the greatest return of any of the cedar products harvested. These can be taken out at the same time as the hemlock. The following gives prices of cedar poles:

<table>
<thead>
<tr>
<th>Price per Linear Foot</th>
<th>Length in Feet</th>
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<tr>
<td>$.02</td>
<td>35 and down</td>
</tr>
<tr>
<td>$.03</td>
<td>36 to 50</td>
</tr>
<tr>
<td>$.04 to $.06</td>
<td>51 and above</td>
</tr>
</tbody>
</table>

Cedar bolts for shingles will bring $1.00 to $1.50 per cord (Forest Service stumpage price), and hop poles will bring two cents or more per linear foot. The bolts and poles can be hewed or cut from the larger decadent cedar, while the smaller cedar taken with the small hemlock can be utilized for poles.

**Minor Products**

The return from minor forest products is very small, and the Crown Zellerbach Corporation has found that the return is not even enough to cover the added cost of administration.
The following gives the Forest Service prices for minor forest products:

- Cascara bark 5 cents per pound
- Burls (Maple) $7.00 to $12.00 per pound
- Ferns 1/4 cent per bunch

During the Christmas season trees can be cut for thinning operations, and a substantial return gained. The prices for trees will range from $0.20 to $0.50 per linear foot.
CONCLUSION

Falling and Bucking

It was first believed that there would be excessive breakage during the main cut due to the small hemlock stumps. However, at the Vail-McDonald operation this has been disproved. A set of good experienced timber fallers, exercising normal care, can minimize all loss due to breakage, and the small hemlock stumps present only a minor problem. To accomplish this, a two-man crew is used, using a one-man, 30-inch power saw or a one-man hand saw. Stump heights have been cut to six and eight inches in this manner.

A normal falling crew with a power saw can fall between 75 thousand and 100 thousand per day. However, due to the ground that must be covered in a prelogging operation the fallers could probably only fall 15 thousand to 35 thousand per day, depending on the topography, tree diameters, and the efficiency of the crew.

Yarding

There have been many mobil yarding machines devised by the different operations. Most of the machines in operation seem to be quite satisfactory except for the fact of the limited yarding distance. This distance has been generally kept down to around 500 feet. Although the cable systems are very mobil, it seems they should be able to reach out further. By the use of a surplus airborne caterpillar tractor this should be accomplished. The "midget" tractors would seem to be the most likely machine to use in prelogging operations where pulp is the main product harvested.
This small tractor would also be a possibility because it would be more versatile among the residual stands. As yet the author has not heard of any of these machines being put to use.

Loading

In handling small logs it was found that in rafting many of the small hemlock logs would sink. To prevent this the small logs were bundled with wire straps. At first only three straps were used, but it was found that there was considerable strap breakage when the package of logs was dumped. By the addition of a fourth strap this breakage was minimized. One of the problems in strapping is the re-use of the strap. At present, it is only possible to re-use the strap once. The Crown-Zellerbach Corporation is now experimenting with a wire rope strap with a one-half-inch hook. So far, there has not been any published data on this.

Preloading has been tried only by the Crown Zellerbach Corporation. Although it has proved to be fairly satisfactory, there still seem to be too many re-handlings.

Road Construction

The main roads on most of the operations are utilized to their full extent. The logs are yarded to the roadside, loaded, and trucked off to the mill or re-load station. It has not been found feasible to construct roads especially for the prelogging operations.

The Products

The major products include sawlogs, pulpwood, poles, piling, and cedar bolts for shingles. From these products the greatest returns can be realized. By using good thinning and salvage technique a much greater volume per acre may be recovered. In his address to the 37th Annual Meeting of the Western Forestry and Conservation Association,
Vincent W. Bousquet stated that, "while the value of the products from thinning as yet cannot pay for themselves, the necessary roads, the costs of production, and make, in addition, a return on the stumpage, such products do appreciably increase the yield from each acre and provide more volume over which to spread the total cost of timber management."

As yet there has been little done in the way of utilizing the minor products such as cascara bark, Christmas trees, burls, or ferns. The added cost of administration makes this uneconomically feasible. By the use of a permit, as is done on Forest Service land, maybe this problem can be overcome.
BIBLIOGRAPHY


