Evaluating Dead Lodgepole Pine for Products

Thomas D. Fahey

Abstract

Dead lodgepole pine is a resource currently abundant in the intermountain West. Possible uses for dead pine range from small power poles in fuel and fiber. Values for products that can be produced from dead trees are evaluated based on on-site volume of fiber for both logs and products. The technique can be adapted by the reader to make allocation choices among products for any species.

Specific products evaluated as uses for roundwood products are power poles, house logs, and corral poles. These products return high values per unit of log, but have restrictive specifications and limited markets. Solid wood products include random length dimension stock, lumber, and plywood. Values are lower than roundwood products but specifications are less restrictive and markets are much larger.

Fiber products generally return low values per unit of volume and values vary from never feasible to feasible under some conditions. The techniques are applicable by the reader to diverse situations as: 1) Should economy lumber be chipped under current market conditions? 2) What is the best investment possibility for using a timber resource?

There is a huge volume of dead lodgepole pine in the intermountain region and the Rocky Mountains. A survey by Forest Insect and Disease Control in Region 1 showed 517 million cubic feet of standing dead lodgepole pine in Montana. In Oregon, trees containing an estimated 280 million cubic feet were killed in the years 1970 to 1979 with most of the mortality occurring after 1974. Virtually all of these trees could be used for fuel or more valuable products if they were accessible and had a ready market. There are, however, several constraints on use. Each class of possible product has specifications that vary from very stringent (power poles) to very lax (fuel). These affect how much of the stand volume can be used for any product. In addition, some of the products have limited markets or cost more to produce than their current value. This paper will examine the relationship between specifications, values, market, and the feasibility of using significant volumes of dead lodgepole pine.

To set the stage for what is to come, I want to start with a 1000 base. At that time, Arabian oil cost $1.20 per barrel and other energy sources were priced competitively. Such cheap fuel caused some strange situations. Sawmills were disposing of wood waste in wigwam burners while piping in natural gas to supply energy because the natural gas furnaces were simpler and cheaper to operate than wood burners. The October 1979 issue of Forest Industries has an article (4) on a mill that converted from oil to wood in energy in 1979 and mentions that the mill had originally switched from wood to oil and gas in 1970.

Federal stumpage was then also relatively cheap. In fact, one of the things that has nearly kept pace with the inflation in energy costs is Federal stumpage rates (1,14) (Fig. 1). The forest products industry has undergone a quiet revolution the past 10 years. Scarcity of wood, which is really only a shortage of preferred species and sizes, plus increased stumpage and energy costs have changed both the resource base available to mills and to some extent the products produced. Some products such as underlayment particleboard require so much energy ($14) that production will be converted to more valuable industrial grades or the price will rise to a point where it is no longer competitive.

Deriving Value of Forest Products

To establish a value for a product, a standard unit of measure is needed. The best unit to use would be cubic volume or oven-dry (OD) weight. Because all composition boards and any processed fuel product involves increased density, I will evaluate everything in dollars per OD ton of logs. Physical properties of lodgepole pine differ depending on the source of information (4,10). I am going to use those shown in Table 1.

To determine OD weight of wood plus bark, log cubic volume is determined by Smalian’s formula based on log measurement, then divided by 0.16 to allow for inclusion of bark. Volume and OD density are used to calculate OD pounds of wood plus bark. Cubic volume of products is computed using actual sizes of products and densities adjusted for additional shrinkage in further drying the wood, or in making compressed wood products such as pelletized fuel or particleboard. This allows pricing of all products on the same basis.

The main advantage of dead timber over live timber is that the lower moisture content (MC) of the former is superior for fuel. Low MC is advantageous for dry process composition boards and reduces the cost of drying lumber or veneer. There is little or no advantage of low MC in other products, and there are a great number of process disadvantages to logging and processing dead timber (9,16).

Potential Products From Dead Timber

There are several products that can potentially be produced from dead timber (Table 2). Roundwood products require sound straight tree stock over a limited diameter range. Many trees are not large enough or straight and sound enough for this use.

Solid wood products have less stringent tree size and quality restrictions than roundwood and will, in most stands, be able to utilize considerably more volume per acre. The fuel and fiber products have almost no specifications that limit use and can constitute virtually 100 percent of the volume on an acre that could be used.

Roundwood Products

Power Poles.—Poles are potentially very high value products that can be produced from dead lodgepole pine. Together, Eichhorn and Ralston (10) ran a series of plots and destructively sampled to prove that it was possible to produce poles from dead lodgepole pine trees. Their plots averaged 634 trees per acre of power pole size but at least 16 were not suitable because of defect or deformity. The value of 1 ton of a Class 2 treated power pole is very high (Table 2). I have included an example of the minimum-size pole and a pole of medium size for a Class 2, 40-foot power pole, which is near the top end of the size and value for poles. Average-size poles are worth slightly more than $400 per ton. The volume of bark and log end trim that develops is not enough to use for fuel on any commercial scale so there is little or no anticipated byproduct value.

Corral Poles.—Corral poles are an accepted product from dead lodgepole pine. Value of corral poles including bark are given in Table 4. The value of corral poles is considerably less than the value of pole power and again, there is no expected byproduct value associated with corral poles.

Despite the high values returned, there are several limiting factors to the use of timber for power poles. Currently few places are accepting dead timber for wood poles. A review of the literature on estimating the value of dead timber shows that the estimates are based on the market value of living trees. The value of dead trees is higher than the market value of living trees when the cost of treatment is included. However, the cost of treatment is not included in the estimates of the literature. This is a major factor in the difference between the estimated value of dead timber and the market value of living trees.
Evaluating Dead Lodgepole Pine for Products

Thomas D. Fahey

Abstract
Dead lodgepole pine is a resource currently abundant in the intermountain West. Possible use for dead pine range from small power poles in fuel and fiber. Values for products that can be produced from dead trees are evaluated based on oven-dry tensile strength of fiber for both logs and products. The technique can be adapted by the reader to make allocation choices among products for any species.

Specific products evaluated as uses for roundwood products are power poles, house logs, and cordal poles. These products return high values per unit of log, but have restrictive specifications and limited markets.

Solid wood products include random length dimension, staple, and core veneer. Values for roundwood products but specifications are less restrictive and markets are much larger.

Fiber products generally return low values per unit of volume and values vary from never feasible to feasible under some conditions.

The techniques are applicable to the reader to such diverse questions as 1) Should Economy lumber be chipped under current market conditions? 2) What is the best investment possibility for using a timber resource?

There is a huge volume of dead lodgepole pine in the intermountain region and the Rocky Mountains. A survey by Forest Insect and Disease Control in Region 1 showed 0.17 million cubic feet of standing dead lodgepole pine in Montana. In Oregon, trees containing an estimated 280 million cubic feet were killed in the years 1970-1979 with most of the mortality occurring after 1974. Virtually all of these trees could be used for fuel or more valuable products if they were accessible and had a ready market. There are, however, several constraints on use. Each class of possible product has specifications that vary from very stringent (power poles) to very lax (fuel). These affect how much of the stand volume can be used for any product. In addition, some of the products have limited markets or cost more to produce than their current value. This paper will examine the relationship between specifications, value, and timber resources.

Roundwood Products

Power Poles — Poles are potentially very high value products that can be produced from dead lodgepole pine. Together, Hinds, and Ebykin (1975) ran a series of plots and destructively sampled to prove that it was possible to produce poles from dead lodgepole pine trees. Their plots averaged 43 trees per acre of power pole size but at least 16 were not suitable because of defect or deformity.

Table 1 gives an example of the minimum size pole and a pole of median size for a Class 2, 40-foot power pole, which is near the top end of the size and value for poles. Average-size poles are worth slightly more than $400 per ton. The volume of bark and log end trim that develops is not enough to use for fuel on any commercial scale, so there is little or no anticipated byproduct value.

Corral Poles — Corral poles are an accepted product from dead lodgepole pine. Value of corral poles including bark are given in Table 4. The value of corral poles is considerably less than the value of power poles and again, there is expected byproduct value associated with corral poles.

Despite the high values returned, there are several limiting factors to the use of timber for corral or power poles. Currently few poles are accepting dead timber for increased density, I will evaluate everything in dollars per OD ton of logs.

Physical properties of lodgepole pine differ depending on the source of information (4,10). I am going to use those shown in Table 1.

To determine OD weight of wood plus bark, log cubic volume is determined by Smalian's formula based on log volume, then divided by 0.80 to allow for inclusion of bark. This volume and OD density are used to calculate UD pounds of wood plus bark. Cubic volume of products computed using actual sizes of products and densities adjusted for additional shrinkage in further drying the wood, or in making compressed wood products such as Pelletized fuel or particleboard. This allows pricing of all products on the same basis.

The main advantage of dead timber over live timber is that the lower moisture content (MC) of the former is superior for fuel. Low MC is advantageous for dry process composition boards and reduces the cost of drying lumber or veneer. There is little or no advantage of low MC in other products, and there are a great number of disadvantages to logging and processing dead timber (6,10).

Potential Products From Dead Timber

There are several products that can potentially be produced from dead timber (Table 2). Roundwood products require sound straight trees over a limited diameter range. Many trees are not large enough or straight and sound enough for this use.

Solid wood products have less stringent tree size and quality restrictions than roundwood and will, in most stands, be able to utilize considerably more volume per acre.

The fuel and fiber products have almost no specifications that limit use and could constitute virtually 100 percent of the volume on an acre that could be used.
use as power poles. They are permitted under pole standards but buyers usually specify poles from live trees. One problem with using dead trees is that blue stain fungus, common in dead but not live trees, increases permeability (9) so treating schedules for live-merced trees would have to be changed for dead timbers.

Assuming you could get 30 power poles and 300 corral poles per acre, you would be removing about 15 tons of wood per acre. In stands of dead lodgepole pine, volume (approaches) 100 tons per acre (1). Finally, you could meet the demand for small power poles and provide every house in the West with a private corral and still not touch the acreage that is available.

**House Logs.** The house log is a relatively popular use for dead timber. The specifications (15) for logs are quite stringent and very slightly among manufacturers (Table 5). The minimum diameter, length, and rot restrictions are quite rigid. The other specifications on crook, sweep, and deformities vary slightly with the type of house log being produced. The slabbed four-sided log (Fig. 2) can accept a small sinker or a degree of sweep that would be totally unacceptable for the hand-peeled whole log.

The house log price (Table 6) used here is for the flatted end grist. This result is from lumber grading rules. Round log value varies with log diameter, but no prices were available. Few companies sell house logs; most of them sell only for the house kits.

For the minimum-size log, the values are quite high — $256 per ton. For the average-size log, the value is approximately $300. Because the price of studies is by house log makers are worth even less at $110 per ton of OD wood. In a timber stand of low defect, harvesting house logs could be done at $100 per ton. Potential byproducts from house logs are some chips from squaring log sides and bark and log end trim for fuel. Most log house operators are small to install chippers, so the predominant byproduct is the log end trim sold locally as firewood.

The number of log houses built in the United States per year is estimated to vary between 20 and 50 thousand. Many of these are smaller homes in remote areas. The volume of timber used annually by the house log market is large enough to have a significant impact on the problem but falls short of either full utilization or total stand treatment.

**Solid Wood Products.** As part of the discussion of solid wood products, it is necessary to establish values of wood as fuel because a real part of the revenue derived from either peeling or sawing dead timber will be the opportunity to use or to produce fuel as byproduct.

The value of fuel gathered can be estimated from the value of competing fuels. A problem of conversion is that any new energy source would have to be cheaper to offset the cost of new equipment before it would replace the fuel currently being used. In addition, some fuels are cheaper to use because they are cleaner to burn and require little or no storage space.

Natural gas is a nearly perfect fuel. It comes from a pipe with no storage facilities required and is clean burning in simple standardized furnaces. Oil is only slightly more expensive to use. It varies from slightly dirty to very dirty to burn, and both storage and supply can pose problems. Wood and wood burn in similar furnaces, which are more complex and expensive than either gas or oil furnaces.

Coal is dirtier to burn and handle but is more concentrated than wood. Table 7 shows the current value of wood as a fuel on a heat content basis using 100 tons of 8,000 Btu cord wood. This establishes value of wood as fuel to be $30 per OD ton when compared to coal. It is worth considerably more than the value of an equivalent unit of natural gas.

Lumber. — Research by the Timber Quality Project at the Pacific Northwest Forest and Range Experiment Station has resulted in a series of dead timber recovery studies throughout the West. In every study, it was determined that it is possible (17) to make lumber from dead trees. The margin available for stumpage is always less than that for live trees because the volume recovered as lumber is always somewhat lower, and the lumber grade or average lumber value is always lower. The results of these studies are just being prepared for publication. We have learned that dead timber suffers severe losses in value when made into 1-inch boards. This result is from lumber grading rules. It is necessary to use a grade that severely limit the amount of blue stain allowed in grade 2 Common and Better.

Lumber continues to be a good sale as long as the density of surfaced dry lumber is 240 lb. per ft. It is estimated that the sale of surfaced dry lumber will be $1.35 per 1000 lb. of lumber. This value is slightly less than the approximate weight of various products can be determined (Table 8). Reversing the same weight at a random length dimension mill yields a slightly higher value.

It should be stressed that neither of the mills used in this analysis would be considered particularly efficient. The mill was an old four-row scrag and has since been replaced by a modern mill at the same site. The random length dimension mill, a chipping lathe, was one of the first of that type ever built. Most mills currently in operation could recover more lumber from the same log than either of these mills.

Veneer — Veneer is an inexhaustible commodity for dead lodgepole pine. The Timber Quality Project at the Pacific Northwest Forest and Range Experiment Station has really run a veneer study using dead lodgepole pine as the resource. The lathe was a small diameter, high-speed, 4-foot lathe. Recovery was much better than minimum. The veneer fall apart at the checks even during layup. It dried on a shorter schedule than the veneer from the live control and laid up into panels as well as the control. We did not recognize that the veneer came from dead timber.

40 percent of log volume was recovered as dry veneer, the value would be slightly more than dimension lumber. Veneer represents a possible use for logs larger than 7 inches in diameter. Veneer values are shown in Table 10.

The major advantages to peeling dead lodgepole are the high recovery potential from peeling small logs on a cord mill with a high fuel recovered. Residues from the relatively dry logs could be worth more as fuel than as chips to a plywood plant using natural gas for drying.

There are several points to keep in mind regarding solid wood products. Log specifications vary by mill type and by product. Veneer plants and board mills tend to require larger diameters than dimension and stud mills.
TABLE 5.—Specifications for house logs.

<table>
<thead>
<tr>
<th>Minimum diameter</th>
<th>Maximum length</th>
<th>Rat allowed</th>
<th>Check</th>
<th>1/4 in. thick</th>
<th>Sweep</th>
<th>Taper</th>
<th>Side deformations (knobs, etc.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 in.</td>
<td>18 ft</td>
<td>None</td>
<td>None</td>
<td>1,500 ft</td>
<td>None</td>
<td>None</td>
<td>Minimal</td>
</tr>
</tbody>
</table>

TABLE 6.—Properties and values of house logs (four-sided).

<table>
<thead>
<tr>
<th>Minimum</th>
<th>Average</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small-end diamet. (in.)</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Od diamet. (in.)</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>Volume (cu. ft.)</td>
<td>12.2</td>
<td>14.9</td>
</tr>
<tr>
<td>Weight (lb. per cu. ft.)</td>
<td>400</td>
<td>550</td>
</tr>
<tr>
<td>Value at $1.00/lb.</td>
<td>$238</td>
<td>$326</td>
</tr>
</tbody>
</table>

Price supplied by Corder Lumber Inc., for flat four-sided double tongue and groove log, November 1989.

TABLE 7.—Value of wood as fuel determined on a cost per million btus basis.

<table>
<thead>
<tr>
<th>Resource</th>
<th>Cost ($/lb.)</th>
<th>Value of 1,000 cu. ft. in (lbs.)</th>
<th>Cost / Value of 1,000 cu. ft. in (lbs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural gas</td>
<td>0.18</td>
<td>2.40</td>
<td>66.40</td>
</tr>
<tr>
<td>Oil No. 2</td>
<td>1.87</td>
<td>1.67</td>
<td>56.00</td>
</tr>
<tr>
<td>9,000 Btu coal</td>
<td>0.80</td>
<td>1.67</td>
<td>30.00</td>
</tr>
<tr>
<td>12,000 Btu coal</td>
<td>0.80</td>
<td>1.61</td>
<td>32.00</td>
</tr>
</tbody>
</table>

Figure 2.—Some fairly typical profiles of house logs.

As part of the discussion of solid wood products, it is necessary to establish values of wood as fuel because a real part of the log that will go either by peeling or sawing dead timber will be the opportunity to use or produce fuel as a byproduct.

The value of fuel can be estimated from the value of competing fuels. A problem of conversion is that any new energy source would have to be cheaper to offset the cost of new equipment before we replace the fuel currently being used. In addition, some fuels are cheaper to use because they are cleaner to burn and require little or no storage space.

Native gas is a nearly perfect fuel. It comes from a pipe with no storage facilities required and is clean burning in simple standardized furnaces. Oil is only slightly more expensive to use. It varies from slightly dirty to very dirty to burn, and both storage and supply can be problems. Coal and wood burn in similar furnaces which are compex and expensive than either gas or oil furnaces.

Coal is dirtier to burn and handle but is a more concentrated form of energy than wood. The chart shows the current value of wood as a fuel on a heat content basis, using 18 million Btu per ton of OD wood. This estimate is probably incorrect and would be $33 per ton when compared to coal. It is worth considerably more if substituted for oil or natural gas.

Lumber.—The Timber Quality Project at the Pacific Northwest Forest and Range Experiment Station has resulted in a series of dead timber recovery studies in the West. In every study, it was determined that it is possible (17) to make lumber from dead trees. The margin available for stumpage is always less than that for live trees because the volume recovered as lumber is always somewhat lower, and the lumber grade or average lumber value is always lower.

The results of most of these studies are still being published. We have learned that dead timber suffers severe losses in value when made into 1-inch lumber. This results from lumber grading rules that severely limit the amount of blue stain allowed in grade 2 Common and Better.

The value loss at a random dimension mill is much less. It is not a grading factor for dimension lumber. At a stud mill, the value loss is even less. Because the price of studs is currently lower than the price of dimension lumber, a dimension mill is the optimum place to process dead timber right now. If the stud price recovers relative to dimension, both would have little difference but both would have an advantage over a board mill.

What does a sawmill produce from a ton of dead log? 1000 pounds of log volume is recovered as surfaced dry studs and density is adjusted for shrinkage, the approximate weight of various products can be determined. A 1000-pound mill because the same weight at a random length dimension mill yields a slightly higher value.

It should be stressed that neither of the mills used in this analysis would be considered particularly efficient. The stud mill was an old four-row sawmill and has since been replaced by a modern mill at the same site. The random length dimension mill, a chipping mill, was one of the first of that type ever built. Most mills currently in operation could recover more lumber from the same log than either of these mills.

VENIER.—Venier sounds like an implausible use for dead lodgepole pine. The Timber Quality Project at the Pacific Northwest Forest and Range Experiment Station recently ran a venier study using dead lodgepole pine. The basic idea was small, high-speed, 4 foot lathe. Recovery was much better than anticipated. The venier did not fail apart at the checks even during layup. It dried on a shorter schedule than the veneer from the live control and laid up into panels so well that the layup crew did not recognize that the venier came from dead timber.

If 40 percent of log volume was recovered as dry venier, the value would be slightly more than dimension lumber. Venier does represent a possible use for logs larger than 7 inches in diameter. Venier values are shown in Table 10.

The major advantage to peeling dead lodgepole is the high recovery potential of peeling small logs on a core lathe and the volume of fuel recovered. Residues from lumbering are worth more as fuel than as chips to a plywood plant using natural gas for drivers.

There are several points to keep in mind regarding solid wood products. Log specifications vary by mill type and by product. Venier plants and board mills tend to require larger diameters than dimension and stud mills.

1Unabridged data on file at Pacific Northwest Forest and Range Labs, Sea.

TABLE 9.—Value recovered from a ton of logs at a random dimension lumber mill.

<table>
<thead>
<tr>
<th>Product</th>
<th>Weight (ton)</th>
<th>Value recovered ($/ton)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lumber</td>
<td>425</td>
<td>70.60</td>
</tr>
<tr>
<td>Chips</td>
<td>945</td>
<td>16.85</td>
</tr>
<tr>
<td>Fuel</td>
<td>450</td>
<td>35.00</td>
</tr>
</tbody>
</table>

Value of lumber & chips $70.60 per ton and $16.85 per ton, respectively. However, the value of these products is not determined by the quality of surfaced dry lumber but by the quality of lumber that remains. The value of the lumber in terms of OD volume is $103.25 per ton of lumber.

TABLE 10.—Value recovered from a ton of logs in a veneer operation.

<table>
<thead>
<tr>
<th>Product</th>
<th>Weight (ton)</th>
<th>Value recovered ($/ton)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lumber</td>
<td>425</td>
<td>101.20</td>
</tr>
<tr>
<td>Chips</td>
<td>945</td>
<td>70.60</td>
</tr>
<tr>
<td>Fuel</td>
<td>450</td>
<td>50.00</td>
</tr>
</tbody>
</table>

Value of lumber $101.20 per ton and chips $70.60 per ton, respectively. However, the value of these products is not determined by the quality of surfaced dry lumber but by the quality of lumber that remains. The value of the lumber in terms of OD volume is $144.44 per ton of lumber.

Lumber or venier manufacture produces large amounts of fuel and fiber products. Although up to 70 percent of the total wood volume ultimately becomes fiber, more than 60 percent of the value of the product is derived from the lumber or venier.

Solid wood products could utilize from 70 to 85 percent of the total cubic volume on an acre. Most of the small material left should be susceptible to rapid biological degradation. Also, there are enough potential users to be able to remove a significant volume of dead timber.

Fuel and Fiber Products

Several fiber products can be produced from dead timber. They have lower costs and values, but the raw materials used are either chips or particleboard furnish. Because values are low, logging costs become a very important factor. But there is a possibility of a high value in the future. Paper.—Paper is a relatively high value, high cost product. Yields range from about 40 to 95 percent of the wood volume brought into the plant. Prices range from about $375 to $1,000 per ton. The raw material for most paper is chips, a commodity that has established markets and even private prices.

A value of $40 per ton for chips leaves very little margin for stumpage, logging, and transportation costs. Logging costs range from approximately $30 to $40 per ton ($7 with a fairly realistic estimate for logs to the

Product

Value/ton

Demand

Volume/acre

Probable

market

Power pole

300 to 400

small

5 to 15

small

House logs

210 to 250

moderate

7 to 15

moderate

Mortar

130 to 150

large

25 to 50

large

Decoration

60 to 80

large

10 to 20

large

Fencing

50 to 60

large

5 to 15

large

Particulate

10 to 20

moderate

5 to 15

moderate

Fuel

40 to 50

small

10 to 15

small

At large industrial installations, there is no need to process fuel levels beyond chipping or logging the wood to a uniform size. The potential market for processed wood fuels is limited to small industrial users and institutions (schools, hospitals) which require large amounts of energy but are subject to meeting clean air standards. Processing increases the heat content per unit of volume, a definite advantage in shipping and storing fuels.

Summary

The ability to make commercial products from dead lodgepole pine depends on the market for products and the relative cost of alternative products. The potential (Table 14) for the significant volume depends on how well the resource meets specifications for products and the volume of products that the market will accept.

There are no products discussed for using dead lodgepole pine. The highest priced outlets for dead timber have very limited or moderate demand and are very much disproportionate to the total volume available. The best solutions in terms of land management have relatively limited demand and therefore are not good potential for using volume from very many acres. Lumber and veneer production has some potential for removing relatively large volumes from a lot of acres, but mills are really more profitable operating on green timber sales.

Utilization of this resource will require cooperation and some creative timber marketing and sales contract approaches. Sorting, logging concentrations, and land management contracts are the most common suggestions and probably the most appropriate.

Complete tree logging, with separation of the more valuable logs for roundwood and solid wood products, would allow an in-the-woods chipper to operate on concentrations of chips that would not otherwise be commercially possible.

Development of a structural particleboard and fuel market shows the greatest potential for increased demand for dead lodgepole pine.

Litcrature Cited


Chloropinic Movement and Fungitoxicity in a Decaying Southern Pine Laminated Timber

Barry S. Goodell

Robert D. Graham

Robert L. Krahmer

Abstract

This paper reports on the use of chloropinic to control decay in a southern pine laminated arch. A treatment plan was formulated to obtain information on the effectiveness of a vapor diffusion in containing fumigant vapors in the wood. If the effects of glulamine, fingerjoints, and grain orientation on the effectiveness of chloropinic in the timber, and (3) how well decay fumigants were used in the wood. The results show that over a 5-month period, fungicidal chloropinic vapor diffused up to 2.5 m from the treatment sites near the center of the arch. The vapor trap that enclosed a portion of the arch limited escape of the fungicide from the wood and improved the effectiveness of treatment. Longitudinal diffusion along laminates was much greater than between laminates, in agreement with transverse grain orientation and glulamine limit fungitoxic movement.

Under the conditions of this experiment, we determined that decay could be controlled by applying 0.5 mL of chloropinic per cm² of cross-sectional area at intervals of about 1 m along the timber. Spacing could be increased if a vapor barrier were used.

Laminated timbers, used extensively in structures such as bridges, warehouses, and recreational facilities, are designed to support heavy loads while providing unobstructed spaces below. They are also used frequently in churches, homes, and other modern construction where their aesthetic properties are desirable. Because of inadequate construction codes, portions of untreated laminated timbers are frequently exposed to the weather or are used under humid conditions in structures such as natatoriums, where moisture may condense on the

The authors are, respectively, Graduate Research Asst. and Professor of Forest Products, School of Forestry, Oregon State Univ., Corvallis, OR 97331. The authors acknowledge the financial assistance and cooperation of the American Pinecone Synthetic Inc., the American Plywood Foundation, and the Graduate Research Foundation of Frank W. Johnson, former Research Asst., at the Forest Research Laboratory, Oregon State University. This paper was received for publication in April 1980.

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### Table 14 - Value, probable demand, and potential of various products to reduce significant volumes of dead lodgepole pine.

<table>
<thead>
<tr>
<th>Product</th>
<th>Value per ton</th>
<th>Vol./acre</th>
<th>usable Volume</th>
<th>Probable market</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power poles</td>
<td>300 to 600</td>
<td>5 to 15</td>
<td>small</td>
<td>small</td>
</tr>
<tr>
<td>Horse logs</td>
<td>200 to 400</td>
<td>5 to 15</td>
<td>small</td>
<td>small</td>
</tr>
<tr>
<td>Corral posts</td>
<td>150 to 300</td>
<td>5 to 10</td>
<td>small</td>
<td>small</td>
</tr>
<tr>
<td>Utility poles</td>
<td>150 to 300</td>
<td>5 to 10</td>
<td>moderate</td>
<td>moderate</td>
</tr>
<tr>
<td>Stoves</td>
<td>50 to 120</td>
<td>5 to 50</td>
<td>large</td>
<td>large</td>
</tr>
<tr>
<td>Furniture</td>
<td>50 to 120</td>
<td>5 to 50</td>
<td>large</td>
<td>large</td>
</tr>
<tr>
<td>Pulpwood</td>
<td>50 to 120</td>
<td>5 to 50</td>
<td>large</td>
<td>large</td>
</tr>
<tr>
<td>Pine chips</td>
<td>35 to 50</td>
<td>5 to 50</td>
<td>moderate</td>
<td>moderate</td>
</tr>
<tr>
<td>Forest products</td>
<td>5 to 15</td>
<td>none</td>
<td>none</td>
<td>none</td>
</tr>
<tr>
<td>Fuel</td>
<td>35 to 50</td>
<td>small</td>
<td>small</td>
<td>small</td>
</tr>
</tbody>
</table>

### Summary

The ability to make commercial products from dead lodgepole pine depends on the market for products and the relative cost of alternative products. The potential (Table 14) to use significant volumes depends on how the market meets specifications for products and the volume of products that the market will accept.

There are problems with some of the products discussed for using dead lodgepole pine. The highest priced outlets for dead timber have very limited or moderate demand and can use only very select portions of the volume of products. The best solutions in terms of land management have related limited demand and therefore little potential for using volume from very damaged dead timber. Production has some potential for removing relatively large volumes from a lot of acres, but mills are really more profitable operating on green timber sales.

Utilization of this resource will require cooperation among landowners and timber companies to get the maximum economic potential. The economic potential for timber production and management contracts are the most significant considerations and probably the most appropriate.

Cost-effective logging, with separation of the more valuable logs and wood products from solid wood products, would allow an in-the-woods chipper to operate on concentrations of wood that would not otherwise be commercially possible.

Development of a structural particleboard and fuel market shows the greatest potential for increased demand for dead lodgepole pine.

### Literature Cited


### Abstract

This paper reports on the use of lodgepole in a southern pine laminated arch. A treatment plan was formulated to obtain (information on) the effectiveness of a vapor wrap in containing fumigant vapors in the wood. (b) if the effects of g Declarations, full-joints and grain orientation on the diffusion of chloropicrin in the timber. (c) how well decay fungi were eliminated from the wood. The results show that over a 13 month period, fungitoxic chloropicrin vapors diffused up to 5 m from the treatment sites near the center of the arch. The vapor wrap that enclosed a portion of the arch limited access of chloropicrin from the wood and improved the effectiveness of treatment. Longitudinal diffusion along laminations was much greater than between laminas, indicating that transverse grain orientation and glues limit fungitoxic movement.

Under the conditions of this experiment, we determined that decay could be controlled by applying 0.5 ml of chloropicrin per cu m of cross-sectional area at intervals of about 3 m along the timber. Spacing could be increased if a vapor barrier were used.

### Chloropicrin Movement and Fungitoxicity in a Decaying Southern Pine Laminated Timber

Barry S. Goodell
Robert D. Graham
Robert K. Kramer

Laminated timbers, used extensively in structures such as bridges, warehouses, and recreational facilities, are designed to support heavy loads while providing unobstructed space below. They are also used frequently in churches, homes, and other modern construction where their aesthetic properties are desirable. Because of inadequate construction codes, portions of untreated laminated timbers are frequently exposed to the weather or are used under humid conditions in structures such as restauirants, where moisture may condense on the

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