Hay, which often makes up a considerable portion of a horse’s diet, can vary greatly in quality. As a horse owner, you should consider the quality of the hay you buy before you consider the price. A good quality hay is a better buy because, although it may be more expensive initially, you will use less to satisfy your horse’s needs, with less waste.

REFERENCES

Publications
Oregon State University Extension Service publications and Pacific Northwest Extension publications are available from Agricultural Communications, Publications Orders, Oregon State University, Corvallis, OR 97331-2119. Please add $2.50 shipping and handling for orders up to $25. For orders between $25 and $100, add 15 percent shipping and handling. For orders of $100 or more, please call (503) 754-2513 for a price quote.


Vough, L. R., H. P. Adams, and H. W. Youngberg. Feeding great steers to cattle and horses, Oregon State University Fact Sheet 234 (Corvallis, 1976).

Other Sources

Techni-Serv, Inc., P.O. Box 238, Culver, OR 97734.

Oregon State University Extension Service is an Equal Opportunity Employer.

The Oregon State University Extension Service provides education and information based on current research to help Oregonians solve problems and develop skills related to youth, family, community, farm, forest, energy, and marine resources.

Extension’s agriculture program provides education, training, and technical assistance to people with agriculturally related needs and interests. Major program emphases include food and fiber production, business management, marketing, and processing, and resource use and conservation.

Extension Service, Oregon State University, Corvallis, O. E. S. S. A., director. This publication was produced and distributed in fulfillment of the Acts of Congress of May 8 and June 30, 1944. Extension work is a cooperative program of Oregon State University, the U. S. Department of Agriculture, and Oregon counties.

Oregon State University Extension Service offers educational programs, activities, and materials without regard to race, color, national origin, sex, or disability as required by Title VI of the Civil Rights Act of 1964, Title IX of the Education Amendments of 1972, and Section 504 of the Rehabilitation Act of 1973. Oregon State University Extension Service is an Equal Opportunity Employer.


Other Sources

Techni-Serv, Inc., P.O. Box 238, Culver, OR 97734.

Oregon State University Extension Service is an Equal Opportunity Employer.

The Oregon State University Extension Service provides education and information based on current research to help Oregonians solve problems and develop skills related to youth, family, community, farm, forest, energy, and marine resources.

Extension’s agriculture program provides education, training, and technical assistance to people with agriculturally related needs and interests. Major program emphases include food and fiber production, business management, marketing, and processing, and resource use and conservation.

Extension Service, Oregon State University, Corvallis, O. E. S. A., director. This publication was produced and distributed in fulfillment of the Acts of Congress of May 8 and June 30, 1944. Extension work is a cooperative program of Oregon State University, the U. S. Department of Agriculture, and Oregon counties.

Oregon State University Extension Service offers educational programs, activities, and materials without regard to race, color, national origin, sex, or disability as required by Title VI of the Civil Rights Act of 1964, Title IX of the Education Amendments of 1972, and Section 504 of the Rehabilitation Act of 1973. Oregon State University Extension Service is an Equal Opportunity Employer.

The Woodland Workbook

Acquiring and Using a Portable Sawmill

T. D. Brown and H. E. Wood

Contents

What is a portable sawmill?...

Why own or lease a mill?
Lumber grades...
Cutting patterns and yields...
Overview of mill types...
Circular sawmill with moving carriage...
Advantages and disadvantages...
Cutting the lumber...
Circular sawmill with stationary log...
Advantages and disadvantages...
Cutting the lumber...
Horizontal band sawmill with stationary log...
Advantages and disadvantages...
Cutting the lumber...
Economic considerations in acquiring a portable sawmill...
Safety considerations...
Cutting price...
Calculating selling price...
Selling price...
Appendix: Legal requirements for preventing and controlling forest fires...

For further reading...

Summary...

Why own or lease a mill?

There are several reasons why a woodland owner might be interested in buying or leasing a mill. Consider carefully the volume and grades of wood you need and whether you can use the lumber in a rough green state. If you need only a small amount of lumber, an

Terence D. Brown, Extension forest products specialist, and Norm E. Elwood, Extension forest management specialist, Oregon State University.
alternative is to cooperate with others who want to produce lumber for their own use, thereby sharing the cost of buying the mill.

2. You want to do custom cutting for customers who have their own logs.

3. You want to sell the lumber commercially.

Lumber grades

Before discussing the various types of mills in more detail, we need to review general grades of softwood and hardwood lumber and the rules governing the types of logs you can cut with a mill. The basic family of softwood lumber grades will be the same for all other types of lumber, although the grading rules for hardwood lumber are very different. The most desirable grades are "2 & Better" and "Standard & Better." Softwood lumber is produced in even-foot increments, usually from a minimum of 8 feet up to 24 feet, or the practical limitation of the particular mill. Lumber thicknesses range from 1 inch to over 24 inches from big logs.

In hardwoods, boards are cut to yield the greatest amount of clear wood. Widths are random, and the widest clear boards yield the highest grades. Lumber lengths are in 1-foot increments from 4 to 16 feet. Thicknesses range from 1/8 inch to 6 inches.

In cutting for grade in pine, boards are cut to yield the widest board. In many ways, requirements for cutting pine for "Common" and "Select" (high grade clear) boards are very similar to the requirements for hardwood cutting for grade.

In large-diameter trees, clear wood exists near the surface of the log. This is the highest value wood and produces clear boards. An especially attractive type of lumber that can be produced from the clear portion of the log is vertical grained or VG lumber.

When viewed from the end of the board, the growth rings in VG lumber run across the narrow thickness from face to face (figure 1). If the log was slow-growing, the growth rings will be close together, producing a very fine even grain on the wide face of the lumber as shown. Producing VG lumber requires a specific cutting method (see "Cutting patterns and yields," page 3).

Figure 1.—Vertical-grained lumber, with the typical VG knot produced in this type of cutting

Figure 2.—Mixed grain cutting of structural type lumber, with typical round or oval knots

It's important to note that when you cut dimension lumber from softwoods, producing VG lumber is not desirable. As you can see in figure 1, if VG lumber has knots, they're likely to be spike-shaped knots, running across the width of the piece.

The presence of spike knots in dimension lumber greatly weakens the piece. Don't use lumber with spike knots for structural purposes. Spike knot boards have been eliminated from commercial lumber graded for structural use.

Figure 2 illustrates the grain orientation and resulting round or oval knots produced in cutting structural lumber.

Cutting patterns and yields

Methods of cutting logs into lumber, and the amount of sawdust generated by the saw blade, are the major factors affecting the grade and volume of lumber cut from a log. This is important if you want to get as much lumber as possible from a log with minimum waste.

Think of a log as a tapered cylinder with a large-diameter end and a small-diameter end. The small-diameter end dictates the maximum size of full-length lumber that you can cut from the log. If you expect to cut logs that have a significant amount of clear wood, you'll want a mill that will "full taper saw" the logs. "Full taper sawing" of logs means that the first few cuts along the outside of the log are made parallel to the surface of the log. This creates a full-length board from the clear outside of the log instead of the short piece that would result if you were to use the more conventional cutting methods ("no taper" or "split taper"). In "full taper" sawing, the smaller or tapered pieces come from the inside of the log, where the lowest grade wood is located (because of the presence of knots).
alternative is to cooperate with others who also want to produce lumber for their own use—often, this is an effective solution, especially if several people share the cost of buying the mill.

2. You want to do custom cutting for customers who have their own logs.

3. You want to sell the lumber commercially.

Lumber grades

Before discussing the various types of mills in more detail, we need to review general grades of softwood and hardwood lumber and relate those grades to the types of logs that you can cut with a mill. A basic familiarity with these concepts will help you understand the capabilities of the various mills.

When a tree is young, it has many branches. As it grows in height and diameter in a stand of other trees, a natural pruning process may cause the lower branches to die and (in some species) fall off. Because it's the branches of the tree that create the knots in lumber, any wood that grows over (outside) a knot left by a fallen branch will be clear wood without knots.

For a small second-growth tree, the pruning process may not have occurred. Thus, the knots in the log from that tree extend from the center to the surface of the log.

Softwood logs of this type most often produce dimension or framing lumber for housing, the most common sizes being $2 \times 4$, $2 \times 6$, and $2 \times 12$. The most desirable grades are "2 & Better" and "Standard & Better."

Softwood lumber is produced in even-foot increments, usually from a minimum of 8 feet up to 24 feet, or the practical limitation of the particular mill. Lumber thicknesses range from 1 inch to over 24 inches from big logs.

In hardwoods, boards are cut to yield the greatest amount of clear wood. Widths are random, and the widest clear boards yield the highest grades. Lumber lengths are in 1-foot increments from 4 to 16 feet. Thicknesses range from $\frac{1}{4}$ inch to 6 inches.

In cutting for grade in pine, boards are cut to yield the widest board. In many ways, requirements for cutting pine for "Common" and "Select" (high grade clear) boards are very similar to the requirements for hardwood cutting for grade.

In large-diameter trees, clear wood exists near the surface of the log. This is the highest value wood and produces clear boards. An especially attractive type of lumber that can be produced from this clear portion of the log is vertical grained or VG lumber.

It's important to note that when you cut dimension lumber from softwoods, producing VG lumber is not desirable. As you can see in figure 1, if VG lumber has knots, they're likely to be spike-shaped knots, running across the width of the piece. If you want to cut knots, you'll have a significant amount of waste wood. VG lumber is not available for structural uses.

Figure 2 illustrates the grain orientation and resulting round or oval knots produced in cutting structural lumber.

Cutting patterns and yields

Methods of cutting logs into lumber, and the amount of sawdust generated by the saw blade, are the major factors affecting the grade and volume of lumber cut from a log. It's important if you want to get as much lumber as possible from a log with minimum waste.

In cutting logs into lumber, the amount of sawdust generated by the saw blade, the major factors affecting the grade and volume of lumber cut from a log, is important. You want to get as much lumber as possible from a log with minimum waste.

Figure 1.—Vertical-grained lumber with the typical spiked knot produced in this type of cutting.

Figure 2.—Mixed-grain cutting structural type lumber with typical round or oval knots.

THIS PUBLICATION IS OUT OF DATE.

For most current information: http://extension.oregonstate.edu/catalog
Figure 3 shows the length of the boards that result from full, split, and no taper sawing, looking in from the outside of the log. Most mills with movable saws and fixed platforms to hold the log can move the saw. They will not "full taper saw" unless you shim the log on the platform. There are a few exceptions. However, full taper sawing without a shim usually requires a moving carriage that can shift the log sideways on the carriage independently at either end from front to back. For many applications, however, people are more concerned with cutting lumber for building purposes, which produces dimension grades. This eliminates the need to full taper saw.

As we mentioned in "Lumber grades" (page 2), deciding how to place the log in relation to the line of cut affects grade and lumber yield. Another factor affecting grade and lumber yield is the sawing pattern you use. Some mills are limited by the cutting patterns that they can achieve, thus reducing the yield from the log. This is more important to mill users who produce lumber paid for on a board foot yield or grade basis. If you’re cutting logs for your own use, maximizing board foot recovery is less important—though you might still want to cut for clear boards.

Figure 4a, 4b, and 4c illustrate some of the variations you can achieve with three of the most common cutting patterns—no taper, full taper, and split taper sawing. The small circles represents the small-end diameter; the large circles, the large-end diameter.

There are numerous ways to cut a log into lumber, depending on the sawing method and the sizes and types of lumber to be cut. As we discuss each mill type, we’ll include the most appropriate sawing methods of those shown in figures 4a, 4b, and 4c.

The mill operator will then have one or two basic methods for cutting logs, cutting for grade or for volume recovery.

Many mill operators will do custom cutting for themselves or someone else. Getting the absolute maximum board foot recovery from a particular log in that situation won’t be as important as cutting the material desired. Using the appropriate sawing method from figure 4a, 4b, or 4c will be important.
Figure 3 shows the length of the boards that result from full, split, and no taper sawing, looking in from the outside of the log. Most mills with movable saws and fixed platforms to hold the log cut with no taper. They will not "full taper saw" unless you shim the log on the platform. There are a few exceptions, however. Full taper sawing without a shim usually requires a moving carriage that can shift the log sideways on the carriage independently at either end from front to back. For many applications, however, people are more concerned with cutting lumber for building purposes, which produces dimension grades. This eliminates the need to full taper saw.

As we mentioned in "Lumber grades" (page 2), deciding how to place the log in relation to the line of cut affects grade and lumber yield. Another factor affecting grade and lumber yield is the sawing pattern you use. Some mills are limited by the cutting patterns that they can achieve, thus reducing the yield from the log. This is more important to mill users who produce lumber paid for on a board foot yield or grade basis. If you're cutting logs for your own use, maximizing board foot recovery is less important—though you might still want to cut for clear boards.

The mill operator will then have one or two basic methods for cutting logs, cutting for grade or for volume recovery. Many mill operators will do custom cutting for themselves or someone else. Getting the absolute maximum board foot recovery from a particular log in that situation won't be as important as cutting the material desired. Using the appropriate sawing method from figure 4a, 4b, or 4c will be important.
Full taper sawing
Variation 1 (1" or 2" vertical grain lumber)
A, C, E = 1" or 2" boards (mixed grain)
B, D, F, G = 4" cants

Variation 2 (1" or 2" vertical grain lumber)
A, C, E = 1" or 2" boards (mixed grain)
B, D, F, G = 4" cants

Variation 3 (1" to 6" lumber in any combination)

Rotate 90°

Vertical grain

Figure 4b Variations available with full taper sawing

Split taper sawing

Rotate 180°

Figure 4c. Split taper sawing

For the commercial producer of lumber who's cutting primarily dimension or structural lumber, cutting for maximum volume is important. Diameter and taper are critical in cutting for maximum board foot recovery. Because of the great number of possible combinations of diameter and taper and length, it's beyond the scope of this publication to cover cutting for maximum board foot yield.

It's important to note, however, that the commercial user must make certain that the logs being processed are of the lengths that will yield the most valuable lumber.

For users who may wish to cut for maximum board foot yield, I's there a Best Sawing Method? would be a good reference.

Mill location

Because slabs, edgings, and sawdust accumulate, the location you choose for the mill must be accessible to vehicles that can remove this residue, especially if you plan to operate the mill permanently. Residue removal is less of a problem if you move the mill often. One of the advantages of a portable mill is the ability to place it close to the logs to be processed.

The disadvantage is the need to transport the lumber from the forest to the job site or point of sale. Obviously, it's easier to transport lumber than logs. It's also easier to leave the residue, especially the sawdust, in the woods, rather than to haul it away from the building site or point of sale.

At the mill site, it's important to blow sawdust well away from the area of operation. Pile slabs and edgings well away from the work area, and away from streams and drainageways. Be sure to allow for enough room to stack boards.

References to other publications

When you're referred to another OSU Extension Service publication, or to one from another publisher, you'll find additional information in "For further reading," page 17.
For the commercial producer of lumber who’s cutting primarily dimension or structural lumber, cutting for maximum volume is important. Diameter and taper are critical in cutting for maximum board foot recovery. Because of the great number of possible combinations of diameter and taper and length, the scope of this publication does not cover cutting for maximum board foot yield.

It’s important to note, however, that the commercial user must select the lengths that will yield the most valuable lumber.

For users who may wish to cut for maximum board foot yield, there is a Best Sawing Method? (1984) which would be a good reference.

Mill location

Because slabs, edgings, and sawdust accumulate, the location of your mill must be accessible to vehicles that can remove this residue. Be sure that you observe the minimum requirements for the chosen location. County governments define how they define and treat portable (vs. stationary) and personal-use (vs. commercial) sawmills.

Protect yourself by checking with your county planner or building department before you acquire and place your mill into operation.

Oregon State law (ORS 477.620 and 477.625) requires that operators of mills within 1/8 mile (660 feet) of forest land obtain a written permit from the nearest Oregon State Department of Forestry office. Furthermore, operators of power-driven machinery must take certain fire prevention precautions. These are quite specific; we include excerpts in the appendix.

References to other publications

When you’re referred to another OSU Extension Service publication, or to one from another publisher, you’ll find additional information in “For further reading,” page 17.

THIS PUBLICATION IS OUT OF DATE.
For most current information: http://extension.oregonstate.edu/catalog
Overview of mill types

A wide variety of mills is currently available. They can be grouped into three general categories:

1. Circular mill with a moving carriage. Here, the circular saw remains stationary, and the log is loaded onto a carriage that moves the log through the saw.
2. Circular mill with a moving saw. Here, the log is loaded onto a stationary platform, and the saw passes over the log to cut the lumber.
3. Band mill with moving saw. The log is loaded onto a stationary platform, and the bandsaw passes over the log to cut the lumber.

Instead of including the mill specifications as we discuss each mill type, we've grouped them together in Table 1.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Circular, moving carriage</th>
<th>Circular, moving saw</th>
<th>Band mill, moving saw</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum log diameter</td>
<td>4&quot;</td>
<td>4&quot;</td>
<td>4&quot;</td>
</tr>
<tr>
<td>Minimum log length</td>
<td>8'</td>
<td>8'</td>
<td>8'</td>
</tr>
<tr>
<td>Maximum log length</td>
<td>25 MFB</td>
<td>25 MFB</td>
<td>25 MFB</td>
</tr>
<tr>
<td>Daily production</td>
<td>12,000</td>
<td>12,000</td>
<td>12,000</td>
</tr>
<tr>
<td>Mill cost</td>
<td>$4,000-$20,000</td>
<td>$4,000-$20,000</td>
<td>$4,000-$20,000</td>
</tr>
<tr>
<td>Power source</td>
<td>240V, 60Hz</td>
<td>240V, 60Hz</td>
<td>240V, 60Hz</td>
</tr>
<tr>
<td>Weight (lb)</td>
<td>300-500</td>
<td>300-500</td>
<td>300-500</td>
</tr>
<tr>
<td>Setup/operations</td>
<td>Manual or auto</td>
<td>Manual or auto</td>
<td>Manual or auto</td>
</tr>
<tr>
<td>Area required (sq ft)</td>
<td>20' x 20'</td>
<td>20' x 20'</td>
<td>20' x 20'</td>
</tr>
<tr>
<td>People required</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Time (days)</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Knife type</td>
<td>Circular</td>
<td>Circular</td>
<td>Band</td>
</tr>
<tr>
<td>Band material</td>
<td>4-5 MFB/lb</td>
<td>4-5 MFB/lb</td>
<td>4-5 MFB/lb</td>
</tr>
<tr>
<td>Blade life</td>
<td>30 MFB/lb</td>
<td>30 MFB/lb</td>
<td>30 MFB/lb</td>
</tr>
<tr>
<td>Mill cost</td>
<td>$7,000-$15,000</td>
<td>$6,000-$20,000</td>
<td>$3,000-$5,000</td>
</tr>
<tr>
<td>Maximum log length</td>
<td>4'</td>
<td>4'</td>
<td>4'</td>
</tr>
<tr>
<td>Minimum log diameter</td>
<td>3/16&quot;-1/4&quot;</td>
<td>3/16&quot;-1/4&quot;</td>
<td>3/16&quot;-1/4&quot;</td>
</tr>
<tr>
<td>Maximum log diameter</td>
<td>1-2</td>
<td>1-2</td>
<td>1-2</td>
</tr>
<tr>
<td>Cutting pattern</td>
<td>Full taper (figure 4a)</td>
<td>Full taper (figure 4a)</td>
<td>Full taper (figure 4a)</td>
</tr>
<tr>
<td>Saw blade type</td>
<td>Circular sawmill</td>
<td>Circular sawmill</td>
<td>Circular sawmill</td>
</tr>
<tr>
<td>Operations</td>
<td>Manual or auto</td>
<td>Manual or auto</td>
<td>Manual or auto</td>
</tr>
<tr>
<td>Cutting speed</td>
<td>60 rpm</td>
<td>60 rpm</td>
<td>60 rpm</td>
</tr>
<tr>
<td>Feed speed</td>
<td>10-100 fpm</td>
<td>10-100 fpm</td>
<td>10-100 fpm</td>
</tr>
<tr>
<td>Saw blade type</td>
<td>1/16&quot;-1/8&quot;</td>
<td>1/16&quot;-1/8&quot;</td>
<td>1/16&quot;-1/8&quot;</td>
</tr>
</tbody>
</table>

Circular sawmill with moving carriage

This mill uses a fixed circular saw and a moving carriage to hold the log and move it past the saw. This type is one of the original designs for portable use. These mills are patterned on the type of cutting equipment used in fixed-location commercial sawmills, but on a smaller and simpler scale.

With this mill, you load the log onto the carriage with an angled platform or log loader, rotate it on the carriage to the proper position for cutting, and clamp it firmly into place by using two or more "dogs." An electric cable drive moves the carriage and log on two tracks past and through the saw.

The operator determines the size of the board to be cut by adjusting the setworks on the carriage. The setworks determine the thickness of the board being cut. Figure 5 illustrates a typical mill of this type.

Advantages and disadvantages. The use of a moving carriage on which you can rotate the log, and the stationary saw system, offer maximum flexibility for cutting full, split, and no taper configurations. The ability to rotate the log easily to cut the high grade material from the outer portion of the log is a great advantage.

This mill will allow you to cut any of the taper methods and variations we've discussed except the no taper variation 2 (figure 4a) and the full taper variation 3 (figure 4b). These two are more suited to mills that cut and edge at the same time.

All mills of this type use inserted teeth in their circular saw blades. Figure 6 shows a typical example of inserted teeth. Saw blades with inserted teeth have the advantage of being easy to sharpen and lasting longer between saw changes. Their disadvantage is that they take a wide cut (or kerf) through the log. This is most important when you use the mill to produce lumber commercially or when you cut very valuable logs.

Sometimes, the greater production rates possible with this type of mill will offset the loss in fiber. Edging requires a separate operation with the moving carriage sawmill.

Any of the side boards produced (boards marked "A" in figure 4b) will need to be edged on another piece of equipment, or by reloading these pieces on the carriage, where you can edge them on the circular sawmill.

With this type of mill, it's not advisable to cut cants, or square timbers that you'd have to cut again, because you'd have to remove the cants from the output side of the mill after your first cuts, then load them up again on the carriage.

Cutting the lumber. In cutting logs that don't have a great deal of clear material, it's unnecessary to cut with the full taper method. The logs can be cut by the split taper method. It's not advisable to cut no taper with a sawmill of this type (the yield is usually less). With this mill, you've purchased the flexibility to move the log relative to the saw with the moving carriage.
Overview of mill types

A variety of mills is currently available. They can be grouped into three general categories:

1. Circular mill with a moving carriage. Here, the circular saw remains stationary, and the log is loaded onto a carriage that moves the log through the saw.
2. Circular mill with a moving saw. Here, the log is loaded onto a stationary platform, and the saw passes over the log to cut the lumber.
3. Band mill with moving saw. The log is loaded onto a stationary platform, and the band saw passes over the log to cut the lumber.

Table 1: Portable sawmill specifications

<table>
<thead>
<tr>
<th></th>
<th>Circular mill, moving carriage</th>
<th>Circular mill, moving saw</th>
<th>Band mill, moving saw</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Characteristics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum log diameter</td>
<td>4&quot;</td>
<td>4&quot;</td>
<td>4&quot;</td>
</tr>
<tr>
<td>Maximum log diameter</td>
<td>36&quot;</td>
<td>No limit</td>
<td>36&quot;</td>
</tr>
<tr>
<td>Minimum log length</td>
<td>4&quot;</td>
<td>4&quot;</td>
<td>Varies</td>
</tr>
<tr>
<td>Maximum log length</td>
<td>Varies</td>
<td></td>
<td>Varies</td>
</tr>
<tr>
<td>Daily production</td>
<td>4-10 MBF</td>
<td>3-8 MBF</td>
<td>12 MBF</td>
</tr>
<tr>
<td>Mill cost</td>
<td>$7,000-$15,000</td>
<td>$6,000-$20,000</td>
<td>$4,000-$20,000</td>
</tr>
<tr>
<td>Weight (lb)</td>
<td>3,000-8,000</td>
<td>700-3,500</td>
<td>200-6,000</td>
</tr>
<tr>
<td>Transport method</td>
<td>P, F, T</td>
<td>P, T</td>
<td>P, T</td>
</tr>
<tr>
<td><strong>Setup/operations</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area required</td>
<td>50' x 100'</td>
<td>50' x 100'</td>
<td>50' x 100'</td>
</tr>
<tr>
<td>People</td>
<td>2</td>
<td>1-2</td>
<td>1</td>
</tr>
<tr>
<td>Operations</td>
<td>2</td>
<td>1-2</td>
<td>1-2</td>
</tr>
<tr>
<td>Time required (hr)</td>
<td>1.2</td>
<td>5-2</td>
<td>1</td>
</tr>
<tr>
<td><strong>Carriage</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moving</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Stationary</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Cutting pattern</td>
<td>F, S, N</td>
<td>F, S, N</td>
<td>F, S, N</td>
</tr>
<tr>
<td>Requires assembly</td>
<td>Yes/No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Maximum feed speed</td>
<td>60 fpm</td>
<td>10-100 fpm</td>
<td>15-25 fpm</td>
</tr>
<tr>
<td><strong>Saw blade</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kerf</td>
<td>3/16&quot;-3/8&quot;</td>
<td>3/16&quot;-3/4&quot;</td>
<td>1/16&quot;-1/2&quot;</td>
</tr>
<tr>
<td>Blade type</td>
<td>Circular</td>
<td>Circular</td>
<td>Band</td>
</tr>
<tr>
<td>Sharpening before replacement</td>
<td>4-5 MBS/yr</td>
<td>4-5 MBS/yr</td>
<td>1 MBS/yr</td>
</tr>
<tr>
<td>Sharpening after replacement</td>
<td>30-50 MBS/yr</td>
<td>30-50 MBS/yr</td>
<td>8-10 MBS/yr</td>
</tr>
</tbody>
</table>

*Distances between headblocks varies, with clearance at both ends and overhang beyond headblocks.

With this mill, you load the log onto the carriage, where you can edge it on the circular sawmill. Any of the side boards produced (boards marked “A” in figure 4b) will need to be edged on another piece of equipment, or by reloading these pieces on the carriage, where you can edge them on the circular sawmill.

Sometimes, it’s not advisable to cut cants, or square timbers that you’d have to cut again, because you’d have to remove the cants from the output side of the mill after your first cuts, then load them up again on the carriage. With this type of mill, it’s not advisable to cut cants, or square timbers that you’d have to cut again, because you’d have to remove the cants from the output side of the mill after your first cuts, then load them up again on the carriage.

Cutting the lumber. In cutting logs that don’t have a great deal of clear material, it’s necessary to cut with the full taper method. The logs can be cut by the split taper method. It’s not advisable to cut no taper with a sawmill of this type (the yield is usually less). With this mill, you’ve purchased the flexibility to move the log relative to the saw with the moving carriage.
Circular sawmill with stationary log and moving saw

This mill was developed during the mid-1960’s. Small logs are loaded onto a fixed platform, or large logs are sawn right on the ground. A portable track is placed next to the log, and the saws and power plant move down the track to cut the log. With this design, it’s possible to cut the log completely without rotating it.

The logs can be rotated if you desire, however. The saw cuts through the log in horizontal layers from top to bottom, as shown in full taper sawing variation 3 (figure 4b) and no taper sawing variation 2 (figure 4a). There are several methods used to position the track correctly next to the log. For large logs, some mills require bolting setup boards to the ends of the logs. The track is then mounted on the setup boards. An example of this configuration is shown in figure 9.

Another method of positioning the track is to use end stands. Manufacturers provide all-steel end stands, and some also offer end posts to which you attach lumber cut by the mill as the horizontal members. You attach the track to the end stands, which are located at each end of the log. You can raise or lower the end stands, thus moving the track and the attached saw carriage. This allows you to determine the width of the board being cut. Figure 10 shows a typical end stand configuration.

With this arrangement, you need to add only track extensions to make the mill operational. The greatest use of this trailer system is when cutting smaller diameter logs, usually less than 20 inches.

Cutting the lumber. Before beginning a cut, be sure the log is anchored well and the blade rpm has reached operating speed. The first cuts will take place along the top of the log. With these mills, the cut proceeds from left to right, cutting layer by layer down the log as is shown in figure 4a, variation 2 (no taper sawing), or figure 4b, variation 3 (full taper sawing).

After each pass of the saw through the log, a board return plate drops down from the carriage and pulls the board from the log back to the operator as the carriage returns to its starting position. As the carriage returns, the operator takes the board as it moves closer and stacks it along with the lumber already cut.

Advantages and disadvantages. One advantage of this mill is that the saw edges at the same time that it cuts a board. The boards are cut from top to bottom of the log as well as left to right in the log. This allows for flexibility in selecting the cutting method. In addition, large logs can be cut by laying on the ground without having to be moved onto a carriage.

The main disadvantage is the mill’s inability to cut vertical grained lumber as the cutting proceeds to the center of large logs that can’t be conveniently rotated.

Cutting the lumber. Before beginning a cut, be sure the log is anchored well and the blade rpm has reached operating speed. The first cuts will take place along the top of the log. With these mills, the cut proceeds from left to right, cutting layer by layer down the log as is shown in figure 4a, variation 2 (no taper sawing), or figure 4b, variation 3 (full taper sawing).

After each pass of the saw through the log, a board return plate drops down from the carriage and pulls the board from the log back to the operator as the carriage returns to its starting position. As the carriage returns, the operator takes the board as it moves closer and stacks it along with the lumber already cut.

Unless a great deal of log rotation takes place, and adjustments of the end stands are made, it’s not easy to cut full taper lumber from the outside of each log.

Figure 7.—Stationary log, moving circular sawmill

Figure 8.—Edger saws and main saw setup

Figure 9.—Cutting large logs with setup boards

Figure 10.—End-stand configuration
Circular sawmill with stationary log and moving saw

This mill was developed during the mid-1960's. Small logs are loaded onto a fixed platform, or large logs are sawn right on the ground. A portable track is placed next to the log, and the saws and power plant move down the track to cut the log. With this design, it's possible to cut the log completely without rotating it. The logs can be rotated if desired, however. The saw cuts through the log in horizontal layers from top to bottom, as shown in full taper sawing variation 3 (figure 4b) and no taper sawing variation 2 (figure 4a).

Advantages and disadvantages of this design:

Advantages:
- The saw edges at the same time that it cuts a board. The boards are cut from top to bottom of the log, as well as left to right. This allows for flexibility in selecting the cutting method.
- In addition, large logs can be cut lying on the ground without having to be moved onto a carriage.

Disadvantages:
- The mill's inability to cut vertical y-grained lumber as the cutting proceeds to the center of large logs that can't be conveniently rotated.
- Cutting the lumber requires bolting setup boards to the ends of the logs, which are firmly held in place while being cut.

With this mill, you can attach track extensions to increase the maximum length of log being cut. You can add 4-, 8-, and 10-foot sections of track to the basic track section. There are several methods used to position the track correctly next to the log. For large logs, some mills require bolting setup boards to the ends of the logs. The track is then mounted on the setup boards. An example of this configuration is shown in figure 9.

Another method of positioning the track is to use end stands. Manufacturers provide all-steel end stands, and some also offer end posts to which you attach lumber cut by the mill as the horizontal members. You attach the track to the end stands, which are located at each end of the log. You can raise or lower the end stands, thus moving the track and the attached saw carriage. This allows you to determine the width of the board being cut. Figure 10 shows a typical end stand configuration.

Some manufacturers provide trailers that have at least one section of track and the carriage already installed. With this arrangement, you need to add only track extensions to make the mill operational. The greatest use of this trailer system is when cutting smaller diameter logs, usually less than 20 inches.

After assembling the track, the carriage is attached to it. The carriage is the heart of the mill. It consists of the engine or motor and the saw assembly. The controls for operating the feed works is also located here. The feed works transports the carriage down the track as the saws cut the lumber and then returns the carriage back to the operator.

When you use end stands, you must move the logs into position for cutting. Sloped ramps are used to move the logs onto the log holders, which firmly hold the logs in place while being cut. There are several different ways to move the logs onto the log holders. Electrically driven cables can be used. For smaller logs, manual cant hooks or peaveys work well.

Advantages and disadvantages of this design:

Advantages:
- One advantage of this mill is that the saw edges at the same time that it cuts a board. The boards are cut from top to bottom of the log, as well as left to right. This allows for flexibility in selecting the cutting method.
- In addition, large logs can be cut lying on the ground without having to be moved onto a carriage.

Disadvantages:
- The mill's inability to cut vertical b-grained lumber as the cutting proceeds to the center of large logs that can't be conveniently rotated.
- Cutting the lumber requires bolting setup boards to the ends of the logs, which are firmly held in place while being cut.
Horizontal band sawmill with stationary log and moving saw

This mill uses a horizontally mounted moving band saw, which travels on a carriage and passes over the log. It cuts successive boards downward from the top of the log. The log may be placed on either side of the log. In others, the band saw moves on a carriage below the other one on the side of the log. Figure 11 illustrates a horizontal band sawmill with a moving saw.

The cutting method most used with the horizontal band mill is the no taper, live-sawing method shown in figure 4a, variation 1. The log may or may not be rotated. If you want full taper sawing, you can adjust the log with the sawing platform (the taper adjustment available on some models), or you can shim the log.

You'd use the full taper sawing variation 1 of figure 4b. The log can be sawn to produce finished dimension boards. This is more efficient than that of any of the mills we've already discussed.

The production rate of the band mill with moving saws will generally be less than that of any of the mills we've already discussed. By no means should this lower production rate keep you from considering this type of mill. Some band mills are extremely lightweight and portable, require only one person to set up and operate, and are fairly easy to maintain.

Some of these mills don't require as much area for operation as others. This is an advantage. If this is a consideration for you, contact the specific manufacturer if the mill requires less space than the others. Moving the log and operating the mill as others. This may be an advantage. If this is a consideration for you, contact the specific manufacturer if the mill requires less space than the others.

Advantages and disadvantages. The production rate of the band mill with moving saws will generally be less than that of any of the mills we've already discussed. By no means should this lower production rate keep you from considering this type of mill. Some band mills are extremely lightweight and portable, require only one person to set up and operate, and are fairly easy to maintain.

Some of these mills don't require as much area for operation as others. This is an advantage. If this is a consideration for you, contact the specific manufacturer if the mill requires less space than the others. Moving the log and operating the mill as others. This may be an advantage. If this is a consideration for you, contact the specific manufacturer if the mill requires less space than the others.

The most time-consuming part of setting up a mill is positioning the saw. If a mill has a no taper, live-sawing platform, you must position the platform for others with platforms closer to the ground. This only becomes a factor when you cut large logs. A disadvantage of this mill is that when you're canting a log, you must remove the cant from the mill, then reassemble the mill, and cut rectangular timbers. After cutting completely through the log, the boards must be edged as shown in figure 12.

Safety considerations

Recognize the potential danger that can arise from operating the mill. A primary cause of accidents is running a mill without adequate training. Before using any mill, become thoroughly familiar with the operating instructions provided by the mill manufacturer. If possible, talk to someone who's familiar with the maintenance of the running of the mill and who can help you with its initial operation. Use personal safety equipment. Wear clothes that are not loose or floppy. Also wear non-slip shoes, a hard hat, gloves, safety glasses, and ear plugs or ear muffs.

Never attempt to operate your mill without first checking to see that it's working properly and that everything is adjusted. An obvious danger is the saw or saws themselves, even when they're not moving. A high-speed saw cuts and may become entangled. If you're edging the boards as the saws are cutting, you must accumulate them, place them on edge between the side clamps (figure 12), and make the cut. You may consider this a disadvantage.

Cutting the lumber. The first cut takes place along the top of the log. If the log is being cut full taper, the first slab will extend the full length of the log. If not, the first slab (and possibly some of the lumber) will be shorter in length. If you want timbers (cants), you can rotate the log and cut rectangular timbers. After cutting completely through the log, the boards must be edged as shown in figure 12.

Maintenance falls into two broad categories, the mill itself (including the engine) and the saw blades. The best procedure for maintaining a mill is to set up a schedule for doing certain tasks, and recording when those tasks are accomplished.

Table 2 illustrates the most commonly recommended maintenance procedures and their frequencies.

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Task Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Every 2 hours</td>
<td>Check for dull or broken saw teeth</td>
</tr>
<tr>
<td>Daily</td>
<td>Inspect and lube band saw guide bearings</td>
</tr>
<tr>
<td>Weekly</td>
<td>Drain engine oil and replace oil filter and oil filter伫</td>
</tr>
<tr>
<td>Bimonthly</td>
<td>Drain and replace engine oil</td>
</tr>
<tr>
<td>Every 300 hours, or yearly</td>
<td>Adjust engine valves</td>
</tr>
</tbody>
</table>

Maintaining saw blades requires attention to the blade and the teeth. Circular blades and the large (4- to 6-inch) band saw blades must be properly sharpened to show a small amount of “dishing” when laid on a flat surface. This is essential to cutting straight when the blade is hot. Most owners will have to seek professional assistance for this service. Small band saw blades (1- to 2-inch) are not resharpened. Most owners can resharpen and reshape teeth on both circular and band saw blades—either by hand filing and recentering or by using an electric grinder and resharpening machine, available from most manufacturers. Many band saw blades are considered “dispensable” and are not intended to be resharpened.

For most current information: http://extension.oregonstate.edu/catalog
Band mills can cut between 1,000 and 2,000 board feet per day. The thinner kerf, or smaller amount of sawdust removed by the saw, will offset the difference somewhat. By no means should this lower production rate keep you from considering this type of mill. Some band mills are extremely lightweight and portable, require only one person to set up and operate, and are fairly easy to maintain. Some of these mills don’t require as much area for operation as others. This may be an advantage. If this is a consideration for you, be sure to ask the specific manufacturer if the mill needs a level location for operation.

The most time-consuming part of setting up this mill is positioning the log. It’s more of a task for mills that require the log to be rolled up an incline to the sawing platform than for others with platforms closer to the ground. This only becomes a factor when you cut large logs.

A disadvantage of this mill is that when you’re cant sawing, you must remove the cants from the mill, then reload them onto the mill on edge for cutting into boards. Unlike the circular mills that both cut and edge the boards during the initial cutting. If you’re edging the boards being produced, you must accumulate them, place them on edge between the side clamps (figure 12), and make the cut. You may consider this a disadvantage.

Cutting the lumber. The first cut takes place along the top of the log. If the log is being cut full taper, the first slab will extend the full length of the log. If not, the first slab (and possibly some of the lumber) will be shorter in length.

If you want timbers (cants), you can rotate the log and cut rectangular timbers. After cutting completely through the log, the boards must be edged as shown in figure 12.

Safety considerations

Recognize the potential danger that can arise from operating the mill. A primary cause of accidents is running a mill without adequate training. Before using any mill, become thoroughly familiar with the operating instructions provided by the mill manufacturer. If possible, talk to someone who’s familiar with the running of the mill and who can help you with its initial operation.

Use proper personal safety equipment. Wear clothes that are not loose or flouncy. Also wear nonslip shoes, a hard hat, gloves, safety glasses, and ear plugs or our muffs.

Never attempt to operate your mill without first checking to see that it’s working properly and that everything is adjusted. An obvious danger is the saw or edge saws themselves, even when they’re not moving. A high-speed saw cuts skin and bone easier than it cuts wood. You can instantly lose a finger or hand if you get careless around a saw. Saws can catch and throw wood, knots, or bark. Keeping saws sharp will reduce the risk of injury.

Less obvious are the dangers from feeding heavy logs onto your carriage or log-holding platform. A spun, broken, or bad log can instantly cause an injury or burn you. The manufacturer may or may not have included in your manual the instructions for assisting in protruding logs and extricating them from saws.

Fire is another danger that had better be watched for when operating a forest mill. The body of the timber member that appears to work for a while may suddenly catch fire. Be sure to have a shovel and water on hand at all times during the dry season.

General sawmill maintenance. You must perform regular maintenance on any mill in order to function properly. Maintenance is divided into two broad categories, the mill itself (including engine) and the saw blades. The best procedure for maintaining a mill is to set up a schedule for doing certain tasks, and recording when those tasks are accomplished. Table 2 illustrates the most commonly recommended maintenance procedures and their frequencies.

Table 2. — Typical maintenance schedule for a portable sawmill

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Task</th>
</tr>
</thead>
<tbody>
<tr>
<td>Every 2 hours</td>
<td>Check for dull or broken saw teeth</td>
</tr>
<tr>
<td>Daily</td>
<td>Inspect and lubricate the guide bearings</td>
</tr>
<tr>
<td>Remove excess sawdust buildup</td>
<td></td>
</tr>
<tr>
<td>Weekly</td>
<td>Drain and replace engine oil</td>
</tr>
<tr>
<td>Inspect and clean the spark plugs</td>
<td></td>
</tr>
<tr>
<td>Check battery connections</td>
<td></td>
</tr>
<tr>
<td>Check and adjust the oil cooler</td>
<td></td>
</tr>
<tr>
<td>Check and adjust the filter</td>
<td></td>
</tr>
<tr>
<td>Check and adjust the belt tension</td>
<td></td>
</tr>
<tr>
<td>Every 50 hours, or daily</td>
<td>Clean the engine oil cooler</td>
</tr>
<tr>
<td>Check the engine oil level</td>
<td></td>
</tr>
<tr>
<td>Oil the bearings, gears, and bushings</td>
<td></td>
</tr>
<tr>
<td>Check and adjust the hydraulic pressure</td>
<td></td>
</tr>
<tr>
<td>Every 100 hours, or weekly</td>
<td>Check and adjust the hydraulic lines and connections</td>
</tr>
<tr>
<td>Check and adjust the hydraulic cylinders</td>
<td></td>
</tr>
<tr>
<td>Every 200 hours, or monthly</td>
<td>Check and adjust the side clamps</td>
</tr>
<tr>
<td>Check for loose/broken nuts, bolts, and screws</td>
<td></td>
</tr>
<tr>
<td>Check the engine oil level</td>
<td></td>
</tr>
<tr>
<td>Check the hydraulic lines and connections</td>
<td></td>
</tr>
<tr>
<td>Every 500 hours, or yearly</td>
<td>Check the engine oil filter</td>
</tr>
<tr>
<td>Check the engine oil level</td>
<td></td>
</tr>
<tr>
<td>Inspect and adjust all ball bearing races</td>
<td></td>
</tr>
<tr>
<td>Check the engine oil filter</td>
<td></td>
</tr>
</tbody>
</table>

Maintaining saw blades requires attention to both the blade and the teeth. Circular blades and the large (4- to 6-inch) band saw blades must be properly tensioned to show a small amount of "dishing" when laid on a flat surface. This is essential to cutting straight when the blade is hot. Most owners will have to seek professional assistance for this service. Small band saw blades (1- to 2-inch) are not reconditioned.

Most owners can resharpen and reshape teeth on both circular and band saw blades—either by hand filing and resharpening or by using an electric grinder and reconditioning machine, available from most manufacturers.

Many band saw blades are considered "disposable" and are not intended to be resharpened.
Economic considerations in acquiring a portable sawmill

Acquiring a portable mill is a significant decision. Making that decision involves several aspects beyond the purchase price, including insurance, interest payments, and depreciation. This section will cover these topics and provide general guidelines for making an informed decision.

**Economic Considerations**

### Acquiring a Portable Mill

A mill is a substantial investment that requires careful planning and consideration. Here are some key factors to consider when deciding whether to acquire a mill:

1. **Cost of the Mill**
   - **Purchase Price**: The initial cost of purchasing the mill should be the first consideration. This may include the cost of shipping, installation, and taxes.
   - **Depreciation**: Mill depreciation can vary significantly, so it's important to understand how it will be calculated.
   - **Interest Payments**: If purchasing the mill with a loan, interest payments are a significant expense.

2. **Operating Costs**
   - **Depreciation and Tax Considerations**: The mill's setup usually taxed as personal property, but there are scenarios where it may be treated as business property. In this case, depreciation and interest paid qualify as a taxable deduction, providing tax savings.
   - **Operating Costs**: Operating costs include fuel, parts, and maintenance. These costs can vary significantly depending on the mill's size and usage.

3. **Business Considerations**
   - **Insurance**: Liability insurance is a necessity, whether coupled with your personal policy or part of your business coverage. Mill operation can be a dangerous activity, and insurance is crucial.
   - **Leasing**: Leasing a mill is a viable option, especially for those who are not comfortable with high initial costs or don't want to invest in the mill.

### Making the Final Decision

When making a final decision, consider the following:

- **Cost-Benefit Analysis**: Compare the costs against the benefits. This includes the initial investment, operating costs, and tax savings.
- **Personal vs. Commercial Application**: Consider how the mill will be used. Is it for personal use or commercial purposes?
- **Liability Insurance**: Ensure that you have adequate liability insurance to cover any potential accidents.

### Example: Commercial Cutting Your Own Logs and Selling the Lumber

When using the mill commercially, your most pressing question will generally be, “What price should I ask for my cut lumber?” The calculation is quite simple.

**Selling Price (SP)**

You're merely trying to recover money invested in the mill and its operating cost, plus income given up by not selling your logs as logs, plus an amount for profit. This is the selling price, which can be expressed on a basis of dollars per thousand board feet of lumber (MBF).

By making the following assumptions, we can develop a formula to show the calculation:

1. We add three figures: the fixed cost (FC) to recover the earnings forgone (EF) by selling lumber rather than logs, and the operating cost (OC) of the mill.
2. We multiply this total by the profit multiplier (PM).

\[
SP = (FC + EF + OC) \times PM
\]

The next three sections tell you how to determine your fixed cost, earnings forgone, and operating cost. (In the formulas that follow—and in example 2—we show similar calculations for both band and circular sawmills.

**Fixed Cost (FC)**

To obtain the total fixed cost that must be recovered (\(S\) MBF), use this formula:

\[
FC = MI - SV - D + AP
\]

Where:
- \(MI\) = total mill investment
- \(SV\) = mill's salvage value
- \(D\) = total depreciation deduction realized
- \(AP\) = mill's annual production rate (MBF/year)

When you calculate FC, salvage value (SV) and depreciation (D) are important assumptions. We assumed that both mill types would have a salvage value equal to 25% of their original value. For depreciation, we assumed that the mill owner was in a 30% tax bracket and that depreciation was being handled in a straight line approach over a 4-year recovery period.
Economic considerations in acquiring a portable sawmill

Acquiring a portable mill is a significant decision. Making that decision involves several aspects beyond just finding the mill, including purchase price, insurance needs, operating and maintenance costs, tax considerations, and purchase or lease arrangements. We’ll discuss these here and present general examples of how to approach the decision to acquire a mill.

Buying a mill. When you plan to buy a mill, probably foremost in your mind is the purchase price. Your perspective of the price may vary with the reason for buying the mill (personal vs. commercial application). The prices quoted in table 1 aren’t trivial. Buying a mill is a substantial investment. Mill prices vary, so do some comparison shopping!

Two aspects of insurance are important when owning and operating a mill. First, and related to purchase price, the mill is a substantial capital investment worth insuring, especially if you’ll move the mill from site to site, thus increasing its exposure to damage.

Second, mill operation can be a dangerous activity with the potential for personal accident. Adequate liability insurance is a necessity, whether coupled with your personal policy or part of your business coverage. Don’t overlook this important aspect of mill ownership. Your insurance agent can help you obtain adequate protection. Remember the unusual volatility in policy premiums, be sure to consult your agent before acquiring a mill.

Leasing. If you prefer to avoid the purchase price of a portable sawmill, leasing is a popular option. Usually a “lease-to-purchase” arrangement is available, with down payment and lease payments. At the end of the lease term, you have the option to purchase the mill. Most manufacturers recommend leasing if you need a mill for only a short time or a specific job. You can also use the same type of arrangement for a personal rather than a commercial situation.

Don’t overlook this important aspect of mill ownership. Your insurance agent can help you obtain adequate protection. Remember the unusual volatility in policy premiums, be sure to consult your agent before acquiring a mill.

Lump sum cash purchases or purchases with loans are the most common methods. When paying cash, be sure to examine the effect of the outlay on your business and/or personal cash flow. Don’t overlook the possibility of a short-term loan or a cash-loan combination to ease potential cash flow problems. Cash flow worksheets or other aids to projecting cash flow, such as those in Managing a New Business, may be useful.

Remember that there are possible taxation consequences.

Determining tax consequences. Every time you consider purchasing a mill, when you use it in a commercial manner to generate income, the mill qualifies for depreciation treatment. Income received will also be taxable. If you purchase the mill with a loan, interest paid qualifies as a deductible expense, providing the interest is for business and not personal use.

Second, mill operation can be a dangerous activity with the potential for personal accident. Adequate liability insurance is a necessity, whether coupled with your personal policy or part of your business coverage. Don’t overlook this important aspect of mill ownership. Your insurance agent can help you obtain adequate protection. Remember the unusual volatility in policy premiums, be sure to consult your agent before acquiring a mill.

Leasing. If you prefer to avoid the purchase price of a portable sawmill, leasing is a popular option. Usually a “lease-to-purchase” arrangement is available, with down payment and lease payments. At the end of the lease term, you have the option to purchase the mill. Most manufacturers recommend leasing if you need a mill for only a short time or a specific job. You can also use the same type of arrangement for a personal rather than a commercial situation.

Don’t overlook this important aspect of mill ownership. Your insurance agent can help you obtain adequate protection. Remember the unusual volatility in policy premiums, be sure to consult your agent before acquiring a mill.

Lump sum cash purchases or purchases with loans are the most common methods. When paying cash, be sure to examine the effect of the outlay on your business and/or personal cash flow. Don’t overlook the possibility of a short-term loan or a cash-loan combination to ease potential cash flow problems. Cash flow worksheets or other aids to projecting cash flow, such as those in Managing a New Business, may be useful.

Remember that there are possible taxation consequences.

Determining tax consequences. Every time you consider purchasing a mill, when you use it in a commercial manner to generate income, the mill qualifies for depreciation treatment. Income received will also be taxable. If you purchase the mill with a loan, interest paid qualifies as a deductible expense, providing the interest is for business and not personal use.
Calculating selling price (SP). Collecting all these values into the formula we first stated on page 15, we now calculate SP for each mill type:

\[ SP = (FC + OC) \times PM \]

where:
- \( FC \) is fixed cost
- \( OC \) is operating cost
- \( PM \) is profit multiplier

For example:
- For the band sawmill: \( FC = 1800 \) dollars, \( OC = 500 \) dollars, \( PM = 1.15 \)
- For the circular sawmill: \( FC = 5400 \) dollars, \( OC = 680 \) dollars, \( PM = 1.15 \)

The selling price is determined by the above formula:

- \( SP = (1800 + 500) \times 1.15 = 2805 \) dollars
- \( SP = (5400 + 680) \times 1.15 = 7388 \) dollars

Summary

Buying and using a portable mill to produce lumber for yourself and others can be a profitable and satisfying experience. There are many possible reasons for having a mill. Having the type of mill best suited to accomplishing your objectives, however, is a key ingredient in both profitability and satisfaction.

In this publication, we’ve discussed transportation, setup, and operating considerations for circular and band sawmills. We’ve given an overview of lumber grading as it affects cutting patterns and yields from a portable mill. We’ve also discussed safety considerations and general maintenance requirements.

Finally, we discussed and illustrated with examples important economic considerations surrounding a portable mill. This publication is not intended to replace consultation with your financial and tax professional, nor is it intended to replace careful study of the manufacturer’s operating and maintenance manuals.

For further reading

Calculating selling price (SP). Collecting all these values into the formula we first stated on page 15, we now calculate SP for each mill type:

\[
SP = (FC + OC) \times PM
\]

For the band sawmill:
\[
SP = (\$8,000 + 301\times 10,000) \times 1.15 = \$28/MBF\text{ band}
\]

For the circular mill:
\[
SP = (\$12,000 + 301\times 10,000) \times 1.15 = \$28/MBF\text{ circular}
\]

Thus, over the 4 years, $2,400 depreciation savings ($8,000 x 30%) was realized for the band sawmill, and $5,400 ($12,000 x 30%) for the circular mill. Over a 4-year amortization period, FC then becomes:
\[
FC = \left(\frac{\$8,000 - \$2,000}{4\text{ years}}\right) = 225 \text{ MFB/yr band}
\]
\[
FC = \left(\frac{\$12,000 - \$4,000}{4\text{ years}}\right) = 900 \text{ MFB/yr circular}
\]

Earnings forgone (EF). You forgo earnings when you cut your own logs into lumber rather than selling them as logs. From a business perspective, when cutting your own logs into lumber, this sacrificed income is something you'll want to recover.

You can recover it either directly as money when setting a sale price for your lumber as shown here, or as extra volume that must be cut to make your mill pay for itself. Earnings forgone will vary and are calculated as follows:

\[
EF = \text{Mill price for logs} - \text{Logging and transport cost}
\]

You may want to make an additional deduction for taxes, including income and severance taxes.)

In the examples that follow, we've assumed a mill delivered price of $225/MBF for logs, and logging and transport costs of $100/MBF. Thus:
\[
EF = \$125/MBF
\]

It's important to recognize that our assumed earnings forgone may vary considerably, with an important effect on the selling price. When you do this type of analysis for decision making, we recommend that you contact several buyers for current mill prices.

Get a professional forester to help you determine the best logging method and its estimated cost. Don't decide that you'll buy lumber from a portable mill operator then dry, plane, grade it, and sell it as its own.

Calculating custom cutting someone else's logs.

You may cut someone else's logs regardless of whether you purchased your mill for personal or commercial use. What to charge for custom cutting is an important question. Here's one way to calculate the cutting price per MBF of lumber cut.

Cutting price (CP) is very similar to selling price (SP) from example 1. The only difference in either value or calculation procedure is that here we assume you're cutting someone else's logs. This means you don't have to recover earnings forgone from selling lumber rather than logs. Now, you're merely selling a service and need only set a CP high enough to recover the fixed and operating costs plus profit, if desired.

Using the same approach as in example 1, we determine cutting price by adding the fixed cost to recover the operating cost of the mill, then we multiply by the profit multiplier:

\[
CP = (FC + OC) \times PM
\]

FC, OC, and PM are exactly the same as in example 1, where:

\[
FC = \$28/MBF\text{ band}
\]
\[
OC = 2.25/MBF\text{ circular}
\]
\[
PM = 1.15
\]

Summary

Buying and using a portable mill to produce lumber for yourself and others can be a profitable and satisfying experience. There are many possible reasons for having a mill. Having the type of mill best suited to accomplishing your objectives, however, is a key ingredient in both profitability and satisfaction.

In this publication, we've discussed transportation, setup, and operating considerations for circular and band sawmills. We've given an overview of lumber grading as it affects cutting patterns and yields from a portable mill. We've also discussed safety considerations and general maintenance requirements.

Finally, we discussed and illustrated with examples important economic considerations surrounding a portable mill. This publication is not intended to replace consultation with your financial and tax professional, nor is it intended to replace careful study of the manufacturer's operating and maintenance manuals.
Appendix: Legal requirements for preventing and controlling forest fires

Oregon state laws place several requirements and restrictions on logging and power machinery owners and/or operators to help prevent and control forest fires. The full requirements are published in the Oregon Statutes and a booklet titled Oregon Forest Laws, available from the State Forestry Department, 2600 State St., Salem, Oregon 97301.

We've highlighted certain aspects of the requirements. They're not intended to replace your own reading of the statutes to assure compliance.

The following are general provisions excerpted from the Oregon Revised Statutes (ORS) 477.001:

477.620 Requirements concerning installation or operation of mill or plant. (1) Any person operating a mill or plant from which refuse is burned in or within one-eighth of one mile of forest land shall provide and maintain a closed refuse burner of a type and size which, in the judgment of the forester, is adequate to prevent the spread of fire, unless the forester specifies other measures as equally adequate to prevent the spread of fire. The ground around the mill or plant, including the required refusal burner, shall be cleared for a distance of not less than 200 feet unless a lesser distance is specified by the forester.

(2) Any person operating a mill or plant that performs prefabrication or manufacture of forest products, from which refuse is burned in or within one-eighth of one mile of forest land and without burning, shall provide a closed refuse burner of a type and size which, in the judgment of the forester, is adequate to prevent the spread of fire, unless the forester specifies other measures as equally adequate to prevent the spread of fire, unless the forester specifies other measures as equally adequate to prevent the spread of fire. The ground around the mill or plant, including the required refuse burner, shall be cleared for a distance of not less than 200 feet unless a lesser distance is specified by the forester.

477.720 Requirements concerning installation or operation of hand tools used in fire control. (1) Take reasonable precautions which in the judgment of the forester are necessary in the use of fire and to prevent the spread of fire on or from an operation.

(2) Designate a representative authorized to act on all matters having to do with fire control, which representatives shall be available at all times by direct means of communication with the forester.

(3) If operating west of the summit of the Cascade Mountains, close down any part or all of the operation during any period of time when notified that, in the judgment of the forester, conditions exist as described in ORS 477.670.

(4) If operating west of the summit of the Cascade Mountains, furnish and operate such weather instruments as the forester may prescribe as adequate in the judgment of the forester to indicate fire hazard conditions. (Formerly 477.260)

We've excerpted the following material:

A Guide to Legal Requirements for Preventing and Controlling Fires by Operators Logging, Clearing and Constructing on or Near Forest Land in Oregon:

- Permit: Obtain a permit from a forest protection office before operating power driven machinery on land. Permits are required each year. Permits are processed online.

- Notification of Intent to Operate: File a notification of intent to operate with a forest protection office. A notification must be submitted for each operation. (This uses the same form as the permit to operate power driven machinery.)

- Action to Control Fires: The operator must immediately proceed to control and extinguish any fire starting in his operation while he is operating or which results from his operation or any fire which is started from escaped debris or slash burning.

- Clearing Landings: Clear away all flammable debris 50' or more around each machine used for yarding or loading. If an area cannot be cleared, check with the forest officer about leaving the debris and wetting it down when operating. This is acceptable in a few cases.

- Hand Tools for Fire: Supply hand tools for each operation site or at a location designated by the forester. The number of tools depends on the number of people. This chart shows the requirements:

<table>
<thead>
<tr>
<th>Tool Table</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of people in operation: 1-4</td>
</tr>
<tr>
<td>Tool kit</td>
</tr>
<tr>
<td>Axes or Pulaskis</td>
</tr>
<tr>
<td>Shovels</td>
</tr>
<tr>
<td>Hazel hoes or Pulaskis</td>
</tr>
</tbody>
</table>

Fire Tools and Extinguishers for Trucks:

- Equip each truck (3,000 pounds GVW or larger) driven in forest areas for industrial purposes with one fire extinguisher rated by the Underwriters' Laboratories as not less than 4-BC. Extinguishers shall be placed so as to be visible to the operator and ready for instant use.

Spark Arresters and Mufflers for Engines:

- Equip gasoline-powered engines with approved spark arresters unless the forest officer authorizes a muffler under certain conditions.

- All gasoline engines of less than 50 cubic inch displacement must be equipped with factory-installed mufflers. All non-turbo charged engines must be equipped with an approved spark arrester. Diesel trucks must be equipped with a baffled muffler and exhaust system in good repair. The exhaust must extend above the cab or to the end of the truck frame and discharge upward or to the rear.

THIS PUBLICATION IS OUT OF DATE. For most current information: http://extension.oregonstate.edu/catalog
Appendix:

Legal requirements for preventing and controlling forest fires

Oregon state law places several requirements and restrictions on logging and power machinery owners and operators to help prevent and control forest fires. The full requirements are published in the Oregon Statutes and a booklet titled Oregon Forest Laws, available from the State Forestry Department, 2600 State St., Salem, Oregon 97310.

We’ve highlighted certain aspects of the requirements. They’re not intended to replace your own reading of the statutes to assure compliance.

The following are general provisions excerpted from the Oregon Revised Statutes (ORS) 477.001–477.620 Requirements concerning installation or operation of mill or plant: (1) Any person operating a mill or plant from which refuse is burned in or within one-eighth of one mile from forest land shall provide and maintain a closed refuse burner of a type and size which, in the judgment of the forester, is adequate to prevent the spread of fire, unless the forester specifies other measures as equally adequate to prevent the spread of fire.

(2) Any person operating a mill or plant for the prefabrication or manufacture of forest products, from which refuse is disposed of in forest land, shall be cleared for a distance of not less than 200 feet unless a lesser distance is specified by the forester.

(3) If operating west of the summit of the Cascade Mountains, furnish and maintain such weather instruments as the forester may prescribe as adequate to indicate fire hazardous conditions. [Formerly 477.286]

We’ve excerpted the following material from A Guide to Legal Requirements for Preventing and Controlling Fires by Operators Logging, Clearing and Constructing on or Near Forest Land in Oregon:

**Permits:**

- Obtain a permit from a forest protection office before operating any power driven machinery on forest land.
- New permits are required each year. Permits are enforced all year.
- Notification of Intent to Operate:
  - File a notification of intent to operate with a forest protection office. A notification must be submitted for each operation. (This uses the same form as the permit to operate power driven machinery.)

**Action to Control Fires:**

- Equip machinery with working fire tools and a closed refuse burner.

**Clearing Landings:**

- Clear away all flammable debris 50’ or more around each machine used for yarding or loading. If an area cannot be cleared, check with the forest officer about leaving the debris and wetting it down when operating. This is acceptable in a few cases.

**Hand Tools for Fire:**

- Supply hand tools used for each operation site or at a location designated by the forester. The number of tools depends on the number of people. This chart shows the requirements:

<table>
<thead>
<tr>
<th>Tool</th>
<th>No. of people in operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toolbox</td>
<td>1-4</td>
</tr>
<tr>
<td>Axe or Pulaski</td>
<td>1-5</td>
</tr>
<tr>
<td>Shovels</td>
<td>1-5</td>
</tr>
<tr>
<td>Hazel hoes or Pulaskis</td>
<td>1-3</td>
</tr>
</tbody>
</table>

**Fire Extinguishers:**

- Equip each truck (3,000 pounds GVW or larger) driven in forest areas for incident purposes with one hand extinguisher marked “For Fire Only.” It is recommended a tach hazard be attached to the tach that can be closed with a metal seal. The forest officer will seal the box after each inspection. Supply at least one box for each landing or each powered machine. Enforced during the closed fire season.

**Spark Arresters and Mufflers for Engines:**

- Equip gasoline-powered engines with approved spark arresters unless the engine is equipped with a baffled muffler and exhaust system in good repair. The exhaust must extend above the cab or to the end of the frame and discharge upward or to the rear.

**Fire Tools and Extinguishers for Trucks:**

- Equip each truck (3,000 pounds GVW or larger) driven in forest areas for incident purposes with one round pointed No. 4 fire extinguisher marked “For Fire Only.” It is recommended a tach hazard be attached to the tach that can be closed with a metal seal. The forest officer will seal the box after each inspection. Supply at least one box for each landing or each powered machine. Enforced during the closed fire season.

**Fire Extinguishers:**

- Each internal combustion engine used in an operation, except as provided in OAR 43-03-6 shall be equipped with a chemical fire extinguisher rated by the Underwriters’ Laboratories as not less than 4-BC. Extinguisher shall be placed so as to be visible to the operator and ready for instant use.

**Spark Arresters and Mufflers for Engines:**

- Equip gasoline-powered engines with approved spark arresters unless the engine is equipped with a baffled muffler and exhaust system in good repair. The exhaust must extend above the cab or to the end of the frame and discharge upward or to the rear.

**Fire Tools and Extinguishers for Trucks:**

- Equip each truck (3,000 pounds GVW or larger) driven in forest areas for incident purposes with one round pointed No. 4 fire extinguisher marked “For Fire Only.” It is recommended a tach hazard be attached to the tach that can be closed with a metal seal. The forest officer will seal the box after each inspection. Supply at least one box for each landing or each powered machine. Enforced during the closed fire season.

**Fire Extinguishers:**

- Each internal combustion engine used in an operation, except as provided in OAR 43-03-6 shall be equipped with a chemical fire extinguisher rated by the Underwriters’ Laboratories as not less than 4-BC. Extinguisher shall be placed so as to be visible to the operator and ready for instant use.
Woodland Workbook is a collection of publications prepared by the Oregon State University Extension Service specifically for owners and managers of private, nonindustrial woodlands. The Workbook is organized into 11 sections, containing information of long-range and day-to-day value for anyone interested in wise management, conservation, and use of woodland properties: Management Planning, Forest Measurements, Reforestation, Stand Management, Forest Protection, Logging, Marketing Forest Products, Multiple Use, Forestry Issues, Business Management, and Kinds of Assistance.

The Workbook is available in a three-ring binder with tabbed dividers for each section. For information about how to order, and for a current list of titles and prices, write Agricultural Communications, Publications Orders, Oregon State University, Corvallis 97331-2119, or inquire at the office of the OSU Extension Service that serves your county.

Extension Service, Oregon State University, Corvallis, O.E. Smith, director. This publication was produced and distributed in furtherance of the Acts of Congress of May 8 and June 30, 1914. Extension work is a cooperative program of Oregon State University, the U.S. Department of Agriculture, and Oregon counties.

Oregon State University Extension Service offers educational programs, activities, and materials—without regard to race, color, national origin, sex, or disability—as required by Title VI of the Civil Rights Act of 1964, Title IX of the Education Amendments of 1972, and Section 504 of the Rehabilitation Act of 1973. Oregon State University Extension Service is an Equal Opportunity Employer.