Timber harvesting is a common activity on many small woodland properties. Whether a harvest is large or small, landowners must carefully evaluate their overall goals and objectives before beginning. A well-conducted harvest will help realize those goals, but a poor job may lead to disappointing results that have to be endured for a very long time.

Many landowners have little, if any, personal experience with timber harvesting and are unfamiliar with the myriad choices of equipment and methods. The goal of this publication is to assist landowners in selecting the harvesting options most appropriate for their specific timber and property characteristics as well as their unique goals and objectives.

Objectives when conducting a harvest might include:
• Maximize financial return from the stand
• Improve stand vigor, growth, and yield and product quality
• Protect streams and water quality
• Minimize damage to residual trees
• Enhance wildlife habitat
• Enhance recreation opportunities and/or prepare a building site

Well-defined objectives lead to a sound analysis of available harvesting options and development of a sensible harvesting plan. If a contractor will be hired to do the work, a good harvest plan starts with a well-written contract that specifies the equipment and methods for attaining the desired objectives.

Many landowners prefer to do their own timber harvests. While there might be advantages in doing so, all harvesting activities are inherently dangerous, and safety must be the foremost consideration throughout the entire operation.
Choosing the best harvest system

Characteristics of the harvest site, particularly timber size and site topography, have the greatest influence in determining the appropriate harvesting system. Performance categories in Table 1 (see pages 4–5) are the main aspects to consider when selecting a system. Whether performing a clearcut, salvage harvest, commercial thinning, or fuel reduction project, the landowner needs to consider all the factors in Table 1 when selecting a harvesting system. The logging crew’s skills also play a major role in how various harvesting systems perform across all categories.

Comparisons among systems within a particular category are generalizations and may occasionally be misleading. The production potential of bulldozers and rubber-tire skidders is listed as “medium,” but under certain circumstances they may out-produce a cable operation described as having a “high” production potential. Within an individual performance category, the descriptors (low, medium, high) often overlap and, when all pertinent categories are considered, a particular system may operate at a lower or higher level than described in the literature.

In addition, the slope and yarding distance limits in Table 1 are merely guidelines. For example, some bulldozers and mechanized systems can operate on slopes steeper than the suggested limits, which serve as caution indicators within a given category. Other factors, such as soil characteristics and rules under the Oregon Forest Practices Act, may affect the range of acceptable limits for a particular system.

Costs can be difficult to compare among different harvesting systems. Costs to consider include the machinery operating costs and the cost per thousand board feet (MBF). The cost per MBF is a better comparative indicator, but landowners also must consider environmental costs. For example, excessive soil disturbance from inappropriate equipment can lead to erosion, stream sedimentation, and reduced site productivity. On-the-ground operating conditions (topography, timber size and volume, etc.) are highly variable from site to site, shifting the relative advantage of each harvesting system and requiring a careful evaluation of specific site conditions.

Selecting the right harvesting system involves considering the size of timber, total volume to remove, production potential, and environmental concerns.
**Timber size and volume per acre**

Timber size is one of the most important aspects to consider. For example, the yarding equipment should move logs efficiently from the stump to the landing. If equipment is too small, struggling to skid logs might lead to unnecessary stand damage or might force the operator to cut logs into shorter lengths, which have lower value. If the equipment is much larger than needed to move logs efficiently, the cost per MBF may be too high or the equipment may cause unacceptable levels of residual-stand and site damage.

The volume of timber removed per acre directly influences harvesting costs and is as important a factor as the size of timber. For details on measuring trees and logs, refer to EC 1127, *Measuring Timber Products Harvested from Your Woodland*; EC 1190, *Stand Volume and Growth: Getting the Numbers*; and EC 1129, *Tools for Measuring Your Forest* (see page 8).

**Topography**

Topography is the other leading factor in determining which harvesting options are feasible and desirable. Gentle terrain generally provides the most options, and everything from horses to large crawler tractors, rubber-tire skidders, and even cable systems may be both possible and practical.

Options decrease as topography becomes steeper and more uneven, placing greater demands on equipment. Crawler tractors and rubber-tire skidders can operate on very steep ground, but at some point practicality and safety become serious concerns and necessitate other choices. Protecting the site from excessive soil disturbance also might become an issue.

Steep slopes, limited road access, and environmental concerns may preclude ground-based equipment and require the use of cable machines or helicopters. Cable harvesting requires a careful evaluation of not only timber size, yarding distance, and production potential, but the contour of the ground as well. The cable needs to be sufficiently elevated to carry the weight of the logs without dragging them through the soil, which can disturb soil excessively.

**Production potential**

The length of time available to complete the job helps determine the daily production rate required. If timber needs to be harvested quickly to avoid wet weather or to capture a high log market opportunity, production potential needs to be high. This is a good time to emphasize the importance of planning ahead. Logging contractors are busier during the dry months, so it is important to schedule the logger long before the desired harvest date. It is imperative that a written contract contain defined starting and
Table 1. General performance of various timber yarding systems.

<table>
<thead>
<tr>
<th>Performance category</th>
<th>Type of timber yarding systems</th>
<th>Horse</th>
<th>Farm tractor</th>
<th>Crawler tractors</th>
<th>Wheeled skidders</th>
<th>Excavators</th>
<th>Mechanized systems</th>
<th>Small cable systems</th>
<th>Large cable systems</th>
<th>Helicopter</th>
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<tbody>
<tr>
<td><strong>Timber size</strong></td>
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<tr>
<td>Gentle slope; less than 5% downhill yarding preferred</td>
<td>Generally excellent with proper practices</td>
<td>Small timber: generally less than 16 inches dbh</td>
<td>Small to medium-size timber: generally less than 20 inches dbh</td>
<td>Capable of handling all sizes in design range of machine</td>
<td>Capable of handling all sizes in design range of machine</td>
<td>Small to large timber, depending on design range of machine</td>
<td>Small to medium-size timber, depending on design range of machine</td>
<td>Small to large timber, depending on design range of machine</td>
<td>Capable of handling all diameters but limited by weight of timber</td>
<td></td>
</tr>
<tr>
<td>Gentle slope; less than 5% downhill yarding preferred</td>
<td>Generally excellent with proper practices</td>
<td>Up to 1,000 ft possible; less than 700 ft preferred</td>
<td>Up to 1,000 ft possible; less than 700 ft preferred</td>
<td>Up to 1,000 ft possible; less than 700 ft preferred</td>
<td>Up to 1,000 ft possible; less than 700 ft preferred</td>
<td>Up to 3,000 ft possible; less than 1,500 ft preferred</td>
<td>Up to 1,500 ft possible; depending on machine design limits</td>
<td>From 1,000 to 5,000 ft possible; depending on machine design limits</td>
<td>Very high hourly costs, but per-MBF rates acceptable depending on yarding</td>
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<td><strong>Topography</strong></td>
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<td>Generally excellent with proper practices</td>
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<td>Gentle slope; less than 5% downhill yarding preferred</td>
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<td><strong>Production potential</strong></td>
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<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low to high</td>
<td>Medium to very high</td>
<td>Low to high</td>
<td>Medium to high</td>
<td>Low to medium</td>
<td>Medium to high</td>
<td>Very high, but weather restricts operability</td>
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<tr>
<td><strong>Production costs</strong></td>
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<td>Per-day rate is low, but per-MBF rates are medium to high</td>
<td>Medium to high depending on timber and site conditions</td>
<td>Medium to high depending on timber and site conditions</td>
<td>Medium to high depending on timber and site conditions</td>
<td>Medium to high depending on timber and site conditions</td>
<td>Medium to high depending on timber and site conditions</td>
<td>Medium to high depending on timber and site conditions</td>
<td>Medium to high depending on timber and site conditions</td>
<td>Very high hourly costs, but per-MBF rates acceptable depending on yarding</td>
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<td><strong>Road access requirements</strong></td>
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<tr>
<td>300–500 ft maximum skidding distance</td>
<td>Medium to high disturbance; soil compaction potential; damage to residual stand possible; can treat slash; medium landings (about 75 ft diameter)</td>
<td>Medium to high disturbance; soil compaction potential; damage to residual stand possible; can treat slash; medium landings (about 75 ft diameter)</td>
<td>Medium to high disturbance; soil compaction potential; damage to residual stand possible; can treat slash; medium landings (about 75 ft diameter)</td>
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<td>Medium to high disturbance; soil compaction potential; damage to residual stand possible; can treat slash; medium landings (about 75 ft diameter)</td>
<td>Medium to high disturbance; soil compaction potential; damage to residual stand possible; can treat slash; medium landings (about 75 ft diameter)</td>
<td>Distance limited only by costs per MBF, as determined by production rate</td>
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<tr>
<td>300–500 ft maximum skidding distance</td>
<td>Medium to high disturbance; soil compaction potential; damage to residual stand possible; can treat slash; medium landings (about 75 ft diameter)</td>
<td>Medium to high disturbance; soil compaction potential; damage to residual stand possible; can treat slash; medium landings (about 75 ft diameter)</td>
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<td>Medium to high disturbance; soil compaction potential; damage to residual stand possible; can treat slash; medium landings (about 75 ft diameter)</td>
<td>Distance limited only by costs per MBF, as determined by production rate</td>
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<td><strong>Stream protection</strong></td>
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<tr>
<td>Generally excellent with proper practices</td>
<td>Can be very good depending on proximity to stream and proper practices</td>
<td>Can be very good depending on proximity to stream and proper practices</td>
<td>Can be very good depending on proximity to stream and proper practices</td>
<td>Can be very good depending on proximity to stream and proper practices</td>
<td>Can be very good depending on proximity to stream and proper practices</td>
<td>Can be very good depending on proximity to stream and proper practices</td>
<td>Can be very good depending on proximity to stream and proper practices</td>
<td>Excellent with proper practices; cables can lift logs across streams</td>
<td>Excellent with proper practices; cables can lift logs across streams</td>
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<td><strong>Site disturbance</strong></td>
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<tr>
<td>Minimal disturbance but may need additional equipment for slash work; small landings (less than 50 ft diameter)</td>
<td>Minimum to high disturbance; soil compaction potential; damage to residual stand possible; can treat slash; medium landings (about 75 ft diameter)</td>
<td>Minimum to high disturbance; soil compaction potential; damage to residual stand possible; can treat slash; medium landings (about 75 ft diameter)</td>
<td>Minimum to high disturbance; soil compaction potential; damage to residual stand possible; can treat slash; medium landings (about 75 ft diameter)</td>
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<td>Minimum to high disturbance; soil compaction potential; damage to residual stand possible; can treat slash; medium landings (about 75 ft diameter)</td>
<td>Minimum to high disturbance; soil compaction potential; damage to residual stand possible; can treat slash; medium landings (about 75 ft diameter)</td>
<td>Minimum to high disturbance; soil compaction potential; damage to residual stand possible; can treat slash; medium landings (about 75 ft diameter)</td>
<td>Minimum to medium disturbance possible; with proper practices; slash handling possible; may damage residual stand in partial cuts; small to medium landings</td>
<td>Minimum to medium disturbance possible; with proper practices; slash handling possible; may damage residual stand in partial cuts; small to medium landings</td>
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<tr>
<td><strong>Availability</strong></td>
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<tr>
<td>Few; depends on local area</td>
<td>Common</td>
<td>Commonly used by most contractors</td>
<td>Commonly used by most contractors</td>
<td>Commonly used by most contractors</td>
<td>More contractors becoming available</td>
<td>More contractors becoming available</td>
<td>Generally available but planning and scheduling may be important to secure a contractor</td>
<td>Common use in western Oregon’s steep slopes; becoming infrequent east of Cascades</td>
<td>Few contractors available</td>
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<td><strong>Additional capabilities</strong></td>
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<tr>
<td>Tractor also capable of traditional farm uses, providing multi-purpose capability</td>
<td>Crawler tractors also used for building roads and landings, installing culverts, and treating slash</td>
<td>Skidders can be used for slash treatment</td>
<td>Excavators also used to build roads and landings and for slash treatment and various excavating operations</td>
<td>Typically highly specialized machines suitable for yarding only</td>
<td>Typically highly specialized machines suitable for yarding only</td>
<td>Typically highly specialized machines suitable for yarding only</td>
<td>Typically highly specialized machines suitable for yarding only</td>
<td>High costs an obstacle for use beyond harvesting</td>
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</tr>
</tbody>
</table>
day. The results can be surprising. A horse may cost $350 per day and a mechanical harvesting or cable system $3,500 a day or more. However, a horse skids approximately one or two truck loads of logs per day, while the mechanized or cable systems produce from six to twenty truck loads per day, resulting in similar costs per MBF for each system.

Special demands such as slash piling, stream protection, installing culverts, and other factors mentioned in Table 1 have a significant impact on the total costs of production and must be considered when comparing the relative costs of different harvesting systems.

Road access
Prior to beginning a harvest operation, a landowner should evaluate road access to determine whether existing roads are:

- Adequate for heavy equipment such as log trucks
- Placed to provide reasonable skidding distances for the intended harvesting system
- Located and constructed in a manner that prevents damage to streams or other sensitive areas

If existing roads are inadequate, then the landowner needs to consider incorporating road improvements and/or road construction clauses into the logging contract.

For each type of harvesting system, locate roads and landings on a map and determine the maximum and average distances the logs will be skidded. Along with the estimated volume to be removed, the logger needs this information to estimate production rates and costs.

Stream protection
Landowners have obligations for stream protection under the Oregon Forest Practices Act. The first step is to determine the class of stream, which can be done by taking a map or aerial photo along with a legal description of the property to the Oregon Department of Forestry (ODF) office that serves that area. ODF stewardship foresters can make a determination from their stream class maps.

Once the class of stream is identified, landowners can determine from the Forest Practices Act regulations the type and level of protection needed. The harvest plan should reflect both the legal requirements and the landowner objectives.

Before the start of any commercial activity related to growing or harvesting forest tree species, it is imperative that the
landowner contact the ODF and file for a Notification of Operations Permit. It is a good idea to work with the ODF to identify areas of concern and to develop satisfactory plans for addressing those concerns prior to beginning operations. Don’t risk violating the Forest Practices regulations!

**Site disturbance**

Site disturbance refers to how the land is affected by the harvest activities. Soil compaction and displacement should be minimized during logging because they can reduce site productivity.

When writing a logging contract, specify the acceptable number and size of landings and skid trails. If certain areas should not be disturbed during harvest, the areas should be clearly identified on the ground and noted in the written contract.

Another aspect of site disturbance is damage to residual trees in a thinning. Because these trees are an investment, it is important to protect them from damage. It is worthwhile to establish acceptable limits of residual-stand damage, with clear penalties for exceeding the limits, in the logging contract.

Slash cleanup is important for reducing fire and insect hazards; however, slash work can disturb sites significantly. Landowners need to determine what amount of cleanup is necessary to meet Forest Practices requirements as well as their own objectives and preferences. This may require a balancing act between slash reduction and minimizing site disturbance.

**Availability of contractor**

This aspect of harvesting emphasizes the importance of planning ahead. Landowners who want to harvest as soon as possible will have a limited selection of contractors. Different harvesting systems require different lead times: a ground-based operator can likely be located on short-term notice, whereas a cable or helicopter operation requires long-term planning due to the limited number of operators. Contact your local ODF or OSU Extension office for information on available contractors.
Summary

Achieving a satisfactory timber harvest depends directly on thorough planning. The guidelines suggested in this publication will help landowners choose a harvesting system that will best meet overall goals and objectives for their woodland property.

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Logging Selectively: A Practical Guide to Partial Timber Harvesting in the Forests of the Inland Northwest and the Northern Rocky Mountains, PNW 534
Measuring Timber Products Harvested from Your Woodland, EC 1127
Planning Woodland Roads, EC 1118
Soil Compaction on Woodland Properties, EC 1109
Stand Volume and Growth: Getting the Numbers, EC 1190
Tools for Measuring Your Forest, EC 1129

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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.

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Published August 2006.