

ONTARIO WOODLOT ASSOCIATION EXTENSION NOTES



Careful Logging Practices: Selecting the Right Harvesting Equipment

The Ontario Woodlot Association published *A Landowner's Guide to Careful Logging in 2009*. The guide offers an overview of careful logging practices to help landowners harvest their woodlots without damaging forests, soil, wildlife habitat, riparian areas or watercourses.

This extension note is intended to complement the guide's logging advice. It provides a more detailed explanation of the best uses of various types of commercial harvesting equipment commonly used in the forests of southern Ontario. The note explains both the advantages and disadvantages of each type of equipment.

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Selecting the right equipment

A wide variety of harvesting equipment is used by the logging industry. The application of careful logging practices, the type of equipment used and operator skill all influence the impact that harvesting can have on a woodlot.

Generally, every logger has a preferred method and set of harvesting equipment to cut trees, bring wood out of the woodlot and prepare it for transport. A logger's preferred harvesting system can be as simple as a chainsaw and cable skidder — or several different pieces of equipment may be used. Although operator skill and care are largely responsible for the quality of a logging operation, equipment should be appropriate for the size, scale and scope of the management activity as well as the prevailing site conditions.

Landowners should inquire about the type of equipment that a logger intends to use before signing a harvesting contract, as the choice of equipment will determine the level of forest disturbance. Also, landowners should insist that loggers use careful logging practices to reduce damage to the forest, landing and access routes.



Skidding equipment

Skidding or moving cut trees in a forest (from the stump to the landing) can be done in several ways and with various types of equipment.

Cable skidders

Cable skidders are versatile four-wheel drive vehicles built for logging and rough terrain. They are the most common harvesting equipment used in southern Ontario because of their flexibility, relatively low cost and moderate weight. They have a blade on the front and a heavy-duty winch mounted on the rear so that one end of the log can be lifted off the ground, improving the ease of skidding. Cable skidders can work in most situations under a variety of operational and site conditions.

The winch allows logs to be pulled to the skidder while on the trail. Cable skidders can carry more than thirty metres of main line, allowing them to winch logs from some distance to the trail. This reduces the likelihood of soil compaction and damage to sensitive areas.

Several chokers are usually attached to the main cable, allowing skidders to collect a number of logs during each trip into the woodlot.

Loggers working in unfrozen lowland forests may use skidders equipped with wide or high flotation tires to reduce soil compaction and rutting. Tracked skidders may be used to operate in wet areas. Alternatively, operations may be conducted when the ground is frozen.



Cable skidders are versatile four-wheel drive vehicles built for logging and they are the most common harvesting equipment used in southern Ontario.

Horses are well-suited for work in lowland forests and woodlots with small volumes of valuable timber.

Grapple skidders

Grapple skidders are similar to cable skidders, except that they are equipped with a hydraulic clam that grabs and lifts one end of the log for skidding. A grapple skidder backs up to every load, and when working with a chainsaw feller, can only grab one tree or log at a time. This is a problem on steep or wet sites, in dense stands, in woodlots with smaller trees and in sensitive areas where minimizing vehicle traffic is important.

Grapple skidders work best and are most commonly used along with mechanized harvesting equipment which pre-bunches trees so the skidder can grab and move numerous logs at one time. They are also used to forward logs from landings to sites with better road access.



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Horse skidding

The use of horses suits sensitive areas or sites with high public visibility where minimal disturbance and little noise are desired. Horses are also well-suited for work in lowland forests, for sites with downhill or level topography and for woodlots with small volumes of valuable timber.

It may not be economical to use horses for harvesting low-value or smaller timber, in large harvest areas or sites with long uphill skids. Some loggers find it is more cost effective to use horses to first skid logs to the main trail and then bring the logs out to the landing with a forwarder. Horses normally skid logs on the ground; however, sleds or carts may be used to make log pulling easier for the horses.

Large landing areas may be required for horse logging, unless other equipment is available to pile and sort wood on the landing. While horse logging can have minimal impacts on a woodlot, a poor logging job or working during the wrong season will produce undesirable results. Another disadvantage is that horses can introduce weeds and invasive species into your woodlot by spreading seeds found in feed and manure.

Forwarders

Forwarders are used to move wood from the bush to a landing for further processing. They are equipped with a log loader and log bunk that is attached or pulled as a trailer. Because a forwarder carries the wood rather than dragging it, there is minimal ground disturbance, and the logs are kept clean. The harvested wood can then be neatly sorted and piled at a landing or road side.



Forwarders are used to move wood from the bush to a landing for further processing and are equipped with a log loader and log bunk that is attached or pulled as a trailer.

A feller-buncher has an arm that holds a tree while another tree is cut and can group trees in a bunch before setting them down.

Modern forwarders are designed and built specifically for this function. They can be equipped with multiple axles and up to eight flotation tires, which reduce the potential for soil compaction and rutting. Many forwarders with multiple rear axles have track attachments that go over the tires to further reduce the potential for damage to the forest floor.

Forwarders are commonly used in combination with single-grip harvesters in plantations and dense stands. In these forests, the harvester cuts, limbs, bucks and piles the wood for the forwarder to pick up.

Mechanical harvesters

Mechanical harvesters are tracked or wheeled vehicles with a hydraulic felling head that cuts the trees. While some machines have a felling head attached directly to a carrier, most have this mounted on a boom that reaches out from the machine to cut the tree.

Some harvesters are assembled by attaching a felling head to a construction excavator (tracked backhoe). If an operator uses an adapted excavator as a harvester, it should have zero to minimal tail swing, which is the distance the back end of the cab swings out over the tracks when the excavator cab turns to the side. A harvester with tail swing forces the travel corridor to be wider than the machine. In dense stands or plantations, a harvester with more than 0.5 metres of tail swing should not be used. Harvesters designed for forestry usually have very little or no tail swing.

Fellers

Fellers are purpose-built harvesters regularly used in larger stands. They have the capacity to cut large trees and place them for limbing or forwarding. A feller-buncher has an arm that holds a tree while another tree is cut and can group trees in a bunch before setting them down.

Fellers approach a tree, reach out with a boom, clasp the tree with hydraulic arms and cut it. The harvester usually directs the tree's fall and brings it (with the boom or by backing up) to a trail. The tree is put on the ground where it is limbed with a chainsaw.



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Table 1: Selecting the Right Harvesting Equipment Notes

	Advantages	Disadvantages	Best Application
Cable Skidders	<ul style="list-style-type: none"> ▪ Flexible and efficient – can work in most woodlots; ▪ Use of winch reduces impact to soil, wet spots and slopes; ▪ Good with trees of varied sizes and smaller trees; and ▪ Winch can collect trees for a full load. 	<ul style="list-style-type: none"> ▪ Low productivity/ high cost when skidding small trees; and ▪ Strenuous physical work associated with pulling out and attaching cables can result in operator driving closer to trees/ logs. 	<ul style="list-style-type: none"> ▪ Natural woodlands or older plantations; and ▪ Small to mid-sized woodlots.
Grapple Skidders	<ul style="list-style-type: none"> ▪ Works well with large or bunched trees on main trails; and ▪ Good for forwarding timber from within the woodlot or to a primary landing. 	<ul style="list-style-type: none"> ▪ Must back up to each tree/log; ▪ Larger and heavier than cable skidders; and ▪ Not good for skidding in sensitive areas (e.g., wet areas, riparian areas). 	<ul style="list-style-type: none"> ▪ High volume harvests, generally used in combination with a mechanical harvester; and ▪ Forwarding logs from a secondary landing.
Horse Skidding	<ul style="list-style-type: none"> ▪ Low impact harvest; ▪ Minimal noise; ▪ Minimal soil compaction; ▪ Can work in smaller stands efficiently; and ▪ Can work with other forwarding equipment to overcome distance/slope limitations. 	<ul style="list-style-type: none"> ▪ Not economical in low-value stands; ▪ Inefficient in woodlots with difficult terrain or large harvest areas; ▪ Can introduce weeds through feed and manure; ▪ More roads required to reduce skid distances; and ▪ No winch – safety concerns when removing lodged trees and must travel to each log, potentially damaging regeneration. 	<ul style="list-style-type: none"> ▪ Sites with high public visibility or sensitive sites with valuable timber, moderate slopes and shorter skid distances.
Forwarders	<ul style="list-style-type: none"> ▪ Carrying the wood causes little soil disturbance; ▪ Logs are clean and piled at the landing or roadside; ▪ Can carry large volumes long distances; and ▪ Tracked attachments on wheels can be used to minimize ground disturbance. 	<ul style="list-style-type: none"> ▪ Machine and log weight can contribute to compaction and rutting. Track attachments and harvesting wet areas when dry can reduce this problem; ▪ Stability problems on steep sites; and ▪ On uneven terrain trails may need to be wider to accommodate machine. 	<ul style="list-style-type: none"> ▪ Plantations or forests with many small trees, generally used in combination with mechanical harvesting equipment.
Mechanical Harvesters (Fellers)	<ul style="list-style-type: none"> ▪ Machines can reach out to cut trees (less off-trail traffic); ▪ Causes minimal damage to dense regeneration; ▪ Trees can be placed close to the trail for forwarding; ▪ Ability to place cut trees precisely, minimizing damage to residual trees; ▪ Can work in all weather; and ▪ Tracks can scuff the forest floor (creating a good seedbed). 	<ul style="list-style-type: none"> ▪ Requires larger woodlots (harvest area) for efficiency; ▪ Difficulty manoeuvring in dense stands of timber; and ▪ On uneven terrain trails may need to be wider to accommodate machine. 	<ul style="list-style-type: none"> • Large woodlots and high volume harvests.
Mechanical Harvesters (Single-grip)	<ul style="list-style-type: none"> ▪ See mechanical harvesters (fellers) above; ▪ Very efficient in plantations and cedar stands; ▪ Has the ability to process trees into logs at the stump; ▪ Can operate with very little stand and soil damage; ▪ Will work well in thinning both natural stands and plantations; and ▪ Tracked attachments on wheels can be used to minimize ground disturbance. 	<ul style="list-style-type: none"> ▪ Has difficulty in harvesting very large timber and processing heavily limbed trees into logs; and ▪ On uneven terrain trails may need to be wider to accommodate machine. 	<ul style="list-style-type: none"> ▪ Plantations and highly stocked stands such as first thinning red pine and cedar.

The feller may place a number of trees in the same spot. The logs are then forwarded by a skidder (cable or grapple) to the landing. In some cases, the whole tree may be forwarded to the landing, where it is limbed and bucked into logs or chipped.

Fellers are efficient enough to keep several skidders occupied, and for economical reasons, are used mainly in larger woodlots. These machines are best suited to work on level areas however, they can operate on moderate slopes. Traction can be a problem in snow, on ice or on steep slopes; feller tracks can be outfitted with cleats or blades to improve traction. However, while cleats or blades will improve equipment traction, they can severely damage soil and roots in the absence of snow or ice.

Single-grip harvesters

Single-grip harvesters (or cut-to-length harvesters) fell, limb and buck each tree, leaving the processed wood in small piles in the woodlot. A forwarder usually picks up the logs and carries them to the landing. Single-grip harvesters are most commonly used to thin plantations and cedar stands. The slash is left scattered in the bush or on the machine's pathway; the latter helps to reduce soil compaction and rutting by the forwarder. This harvest system is an efficient and economical way to harvest small-diameter conifer stands.



Single-grip harvesters fell, limb and buck a tree, leaving the processed wood piled in the woodlot to be picked up by a forwarder.

Single-grip harvesters are available with wheels or tracks. This equipment can be purpose-built or made by modifying construction excavators. The adapted machines are lighter and may have tail swing problems. Tracked harvesters are well-suited to level and moderate terrain. Wheeled machines are faster and operate better on slopes. Many wheeled harvesters have flotation tires to help avoid soil compaction and rutting.

Landing equipment

When wood is brought to the landing it sometimes requires further processing or sorting before hauling. Loggers often buck the skidded logs at the landing and push them into a pile for transport to the mill (where they are sorted and graded). However, many loggers will sort and pile logs on the landing to facilitate processing and hauling to different mills. Skid steers, self-propelled loaders and front-end loaders are most commonly used for this task. Sorting and piling the logs as they come out of the woodlot can reduce the size of the landing.



Logging trucks equipped with hydraulic loaders are commonly used at the landings to load logs for transport to the mill.

Wood-processing equipment

The equipment discussed in this section is used for processing wood on the landing for fuelwood or industrial use. When a suitable landing is available, some loggers will use a fuelwood processor and deliver split wood directly from the landing. Large operators may bring tree-length material (with or without branches) to the landing.

Branches can be removed with a delimber. Delimbed trees are then bucked into logs by a slasher before sorting is done. Loggers who supply larger facilities that produce paper, waferboard, pellets or biomass energy may chip logs on the landing or use whole-tree processing systems. In many cases, the wood is relatively low-grade and the higher-value logs are sorted for sale to other buyers. Processing on the landing requires a relatively large landing area with good road access, since non-forestry trucks may require access to the site for loading.

Slashers

A slasher is usually equipped with a loader that picks up the trees, places them on the slasher bed, and the trees are then cut to length by a large circular saw. The operator can then sort the logs into different product types. A slasher/delimiter cuts off the branches and bucks the logs in one process.



A slasher equipped with a circular saw processes tree length material into various log lengths.

Whole-tree harvesting systems

In whole-tree harvesting systems, the entire tree is cut and brought to a landing for processing. These systems can efficiently harvest most of the wood in a forest. They are well adapted to mechanized harvest systems for low-quality and/or small-diameter stands for industrial use. Because many nutrients are in the fine branches and foliage, removing this material from the forest by whole-tree harvesting may reduce long-term productivity on sites with coarse-textured soils. In some operations this material may be returned to the site utilizing the clam on a grapple skidder.

A common equipment combination for a whole-tree harvesting operation is a feller buncher/grapple skidder working in a forest being managed under the clearcut or shelterwood harvest system.

Delimiters

Delimiters are used to remove limbs in whole-tree harvesting operations. A flail delimiter drives over the trees with a spinning reel of chains, knocking off branches and bark. A stroke delimiter runs a pair of blades along the trunk to shave or break the branches off the trunk. After delimiting, the trunk can be hauled full length, bucked into logs by a slasher or chipped. The branches may be left on the landing, chipped for biomass fuel or mulch or dragged back into the bush.



Stroke delimiters are used to remove limbs in whole-tree harvesting systems.

Chippers

Chippers are used when logs or whole trees (branches included) are chipped to provide wood fibre directly to an industrial facility. The low-grade parts or the whole tree are chipped to specifications for use in pulp and paper, waferboard, wood pellets or biomass fuel. The chips are normally blown directly into a trailer for transportation to the mill. Wood used for paper or waferboard will have limitations on the amount of bark and leaves contained in the chips, but chips used for mulch or fuel may not. A flail chipper is designed to remove much of the bark from the tree before it enters the chipper.



Chippers are used when whole trees are chipped to provide wood fibre directly to an industrial facility.

Glossary of terms

Buck – cutting a felled tree into specified log lengths; also making any bucking cut on logs.

Choker – a short length of cable intended to reach around a log and connect it to the main line.

Felling – the act of cutting down a standing tree.

Forwarding – moving bunched or processed wood from the woodlot to a landing or from one landing to another with road access.

Compaction – compression of the soil by equipment passage that eliminates air pockets, reducing the movement and retention of water and air in the soil.

Landing – the area where timber is collected, cut up and sorted into various products prior to loading for transport.

Main line – a braided cable or synthetic fibre cable that is attached to the winch on the skidder, used to pull trees from where they were felled to the main skid trail for skidding to the landing.

Residual tree/stem – individual trees retained after a harvest.

Rutting – a depression made by the passage of a vehicle or equipment.

Skidding – the process of moving logs or felled trees from the stump to a landing.

Skid trail – a temporary, non-structural trail for logging equipment to drag or carry felled trees or logs to the landing.

Slash – any tree tops, limbs, bark and other wood debris left after a timber harvest.

Tail swing – the distance the back end of the excavator cab swings out past the tracks when an excavator cab turns to the side.

Additional Information

The following guides on harvesting in your woodlot are available from the Ontario Woodlot Association by calling **613-258-0110** or online at **www.ont-woodlot-assoc.org**.

A Landowner's Guide to Selling Standing Timber

A Landowner's Guide to Careful Logging

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