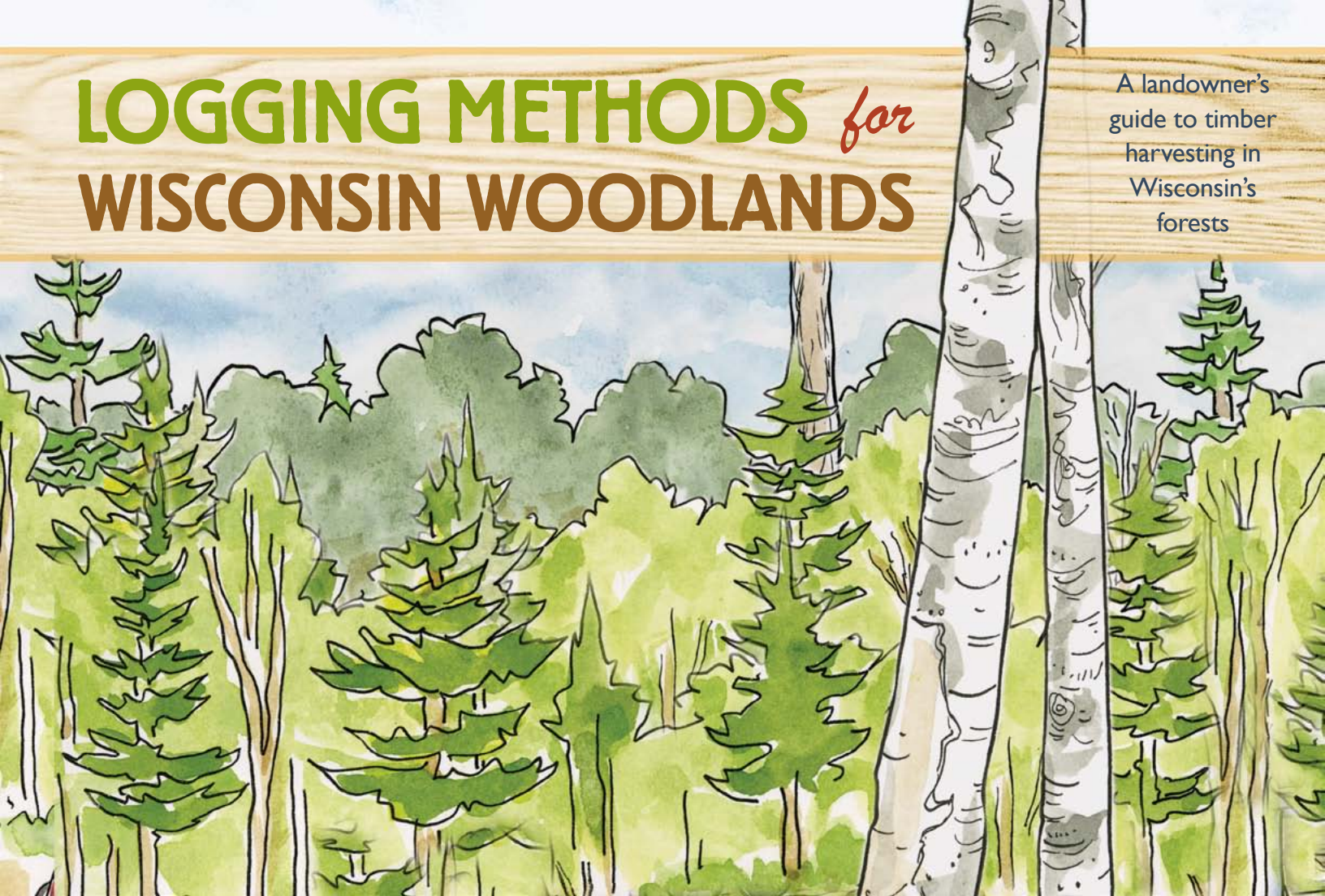
LOGGING METHODS *for* WISCONSIN WOODLANDS

A landowner's guide to timber harvesting in Wisconsin's forests



Timber harvesting is an integral part of sound forest management. It is the means by which landowners achieve many woodland objectives, from creating desirable wildlife habitat to generating timber revenue. Because most woodland owners harvest timber only once or twice in their lifetime, they may not be familiar with modern logging operations. Understanding the machines and systems at work in Wisconsin's woodlands can lead to a successful timber harvest that meets landowner objectives while preserving forest health.

In Wisconsin, most timber is harvested by fully mechanized logging systems. There are several different ways to harvest timber. Whether by chainsaw and horses or with million-dollar machinery, each harvesting system has its place. Selection of a logging method depends on landowner objectives, forest characteristics, terrain, and type of wood products being generated. Whichever method is used, all logging operations follow the same five steps as the trees move from the forest to the mill:

Felling - cutting trees at the stump

Processing - removing tree branches and cutting the stem into appropriate lengths or chipping the whole tree

Extraction - moving whole trees, tree lengths, or logs from the woods to a landing (may occur before or after processing)

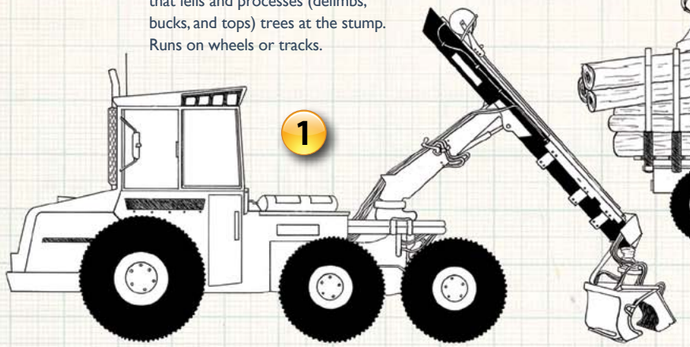
Loading - placing logs or chips onto/into trucks

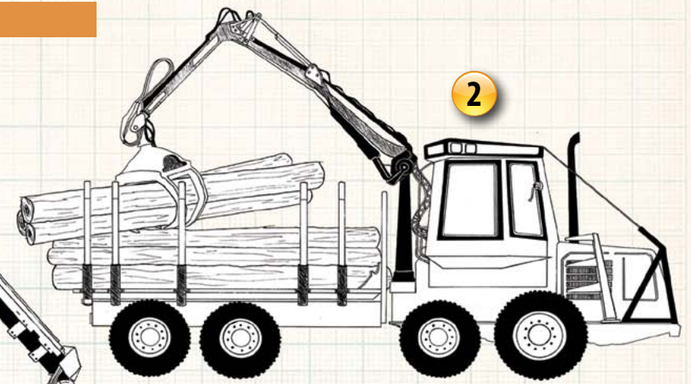
Hauling - delivering logs or chips to the mill

This publication describes the most common timber harvesting equipment and systems used in Wisconsin, with a focus on felling, processing, and extraction. Suitable forestry applications, possible terrain limitations, and regional availability are discussed for each of the six systems. A glossary of common logging terms is located at the end of this publication.

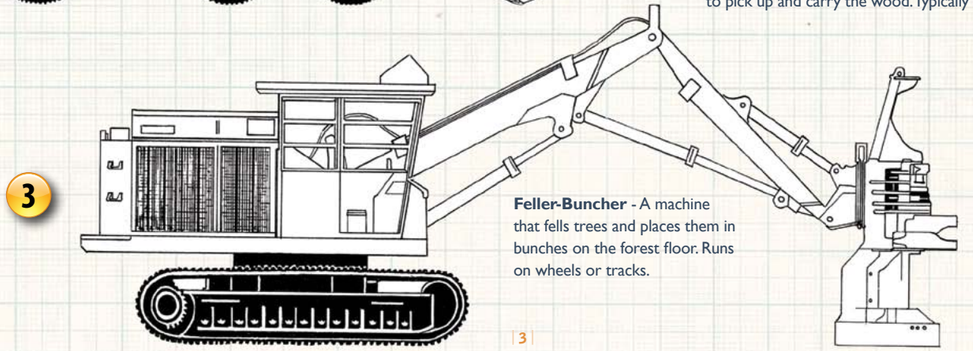
EQUIPMENT DESCRIPTIONS & ILLUSTRATIONS

Feller-Processor (a.k.a. Harvester) - A machine that fells and processes (delimbs, bucks, and tops) trees at the stump. Runs on wheels or tracks.

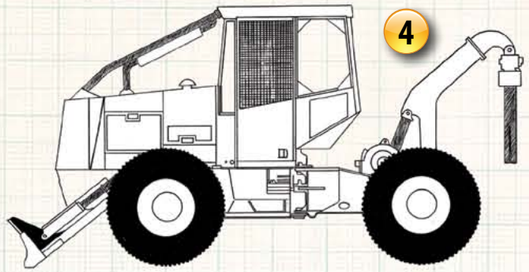




Forwarder - A machine that carries wood (sawlogs, pulpwood, fuel rods or tops) from the forest floor to the landing. It consists of a hydraulic loader and bunk(s) to pick up and carry the wood. Typically runs on wheels.



Feller-Buncher - A machine that fells trees and places them in bunches on the forest floor. Runs on wheels or tracks.



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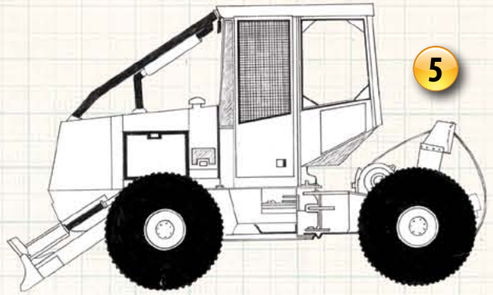
Grapple Skidder - A machine that drags whole trees from the forest floor to a delimber or whole tree chipper using a rear-mounted hydraulic grapple. Typically runs on wheels.



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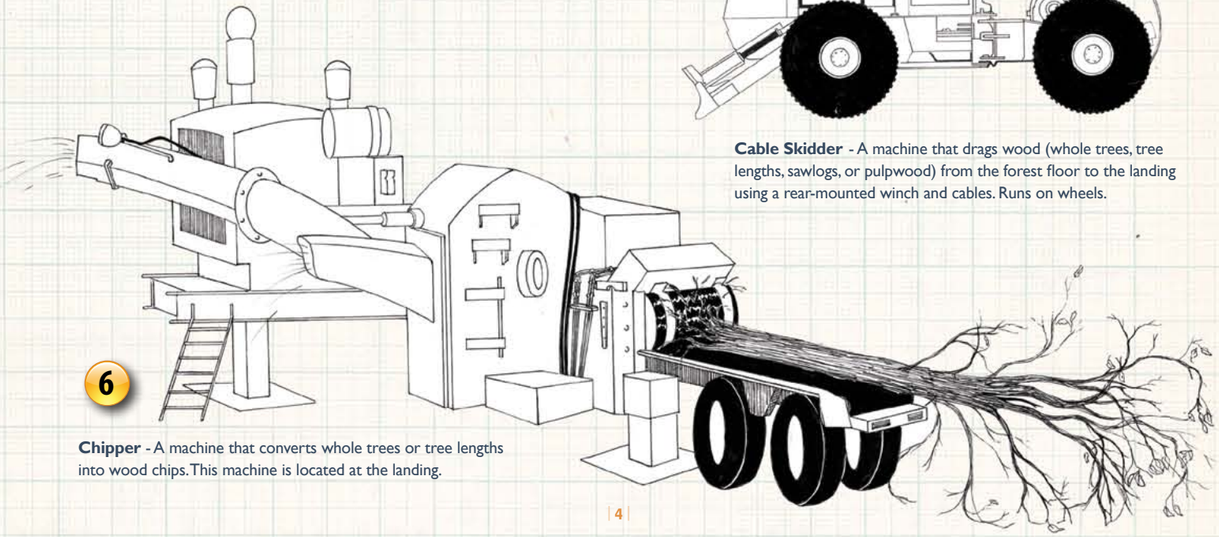
Cable Skidder - A machine that drags wood (whole trees, tree lengths, sawlogs, or pulpwood) from the forest floor to the landing using a rear-mounted winch and cables. Runs on wheels.



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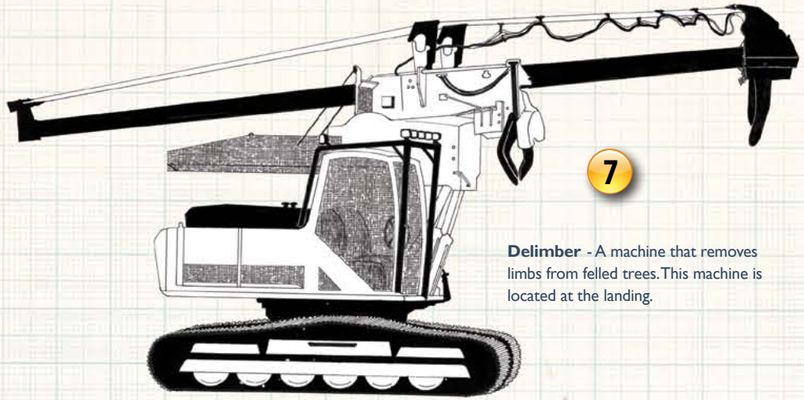
Chipper - A machine that converts whole trees or tree lengths into wood chips. This machine is located at the landing.



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Delimber - A machine that removes limbs from felled trees. This machine is located at the landing.

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Slasher - (No illustration) A machine that bucks delimbed trees into useable lengths such as sawlogs or pulpwood. This machine is located at the landing.

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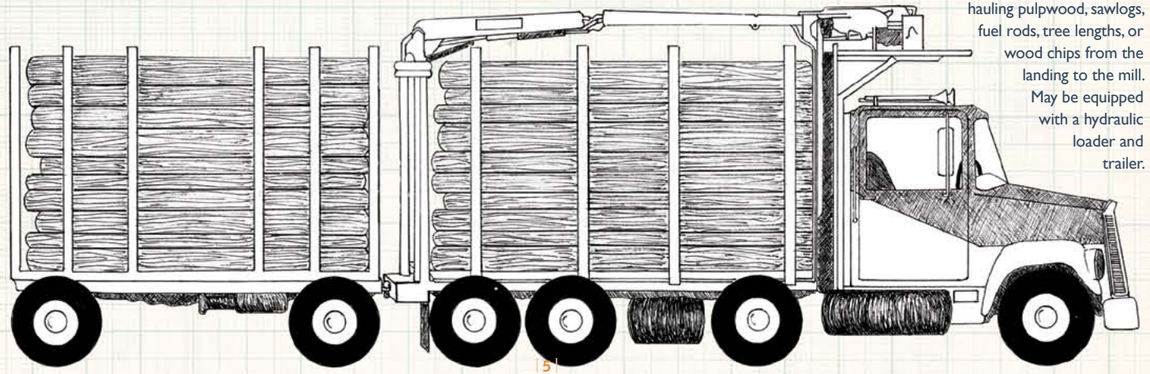
Logging Truck - A vehicle for hauling pulpwood, sawlogs, fuel rods, tree lengths, or wood chips from the landing to the mill. May be equipped with a hydraulic loader and trailer.



Cut-to-length logging is the most technologically advanced timber harvesting system in Wisconsin. Just two machines perform the diverse functions of felling, delimbing, bucking, sorting, extraction, and even, at times, loading. The feller-processor is at the heart of this system. This one piece of equipment does the work of three machines: it fells, delimbs and bucks whole trees into sawlogs and pulpwood at the stump. The felled and processed wood is then hauled to the landing by a forwarder. Cut-to-length logging is used in a variety of logging operations and produces a variety of forest products. It is well suited to partial harvests where protecting residual trees is a high priority.

The cut-to-length system presents several advantages to both the logger and the landowner. Loggers often find that these two machines translate into lower labor, fuel, and maintenance costs. Because the feller-processor sorts processed wood on the forest floor, extraction by the forwarder can be easier. This system is very flexible and can be used in a variety of forest management prescriptions on diverse sites. Landowners often perceive cut-to-length harvesting to be light on the land. The feller-processor reaches from a trail to fell trees and carefully guide them to the ground. This reduces damage to residual trees compared to manual felling. Typically, branches and tops are removed directly in front of the feller-processor. Both the feller-processor and the forwarder drive over this slash as they navigate through the forest. The crushed slash forms a debris mat that protects the soil from compaction and rutting. Low slash height is considered aesthetically pleasing and the debris mat decomposes quickly, returning nutrients to the soil. On a biomass harvest, felled trees are processed to the side of the feller-processor to keep the branches and tops free of dirt and debris.

As efficient as it is, this system does have limitations. Because there is the potential to damage logs and reduce their value, it should not be used to harvest large diameter, high-quality trees. Also, cut-to-length systems should not be used on slopes in excess of 30 percent. Manual felling and processing are preferred in these situations. Cut-to-length systems are uncommon in the hilly southwestern part of the state.

TREE-LENGTH LOGGING

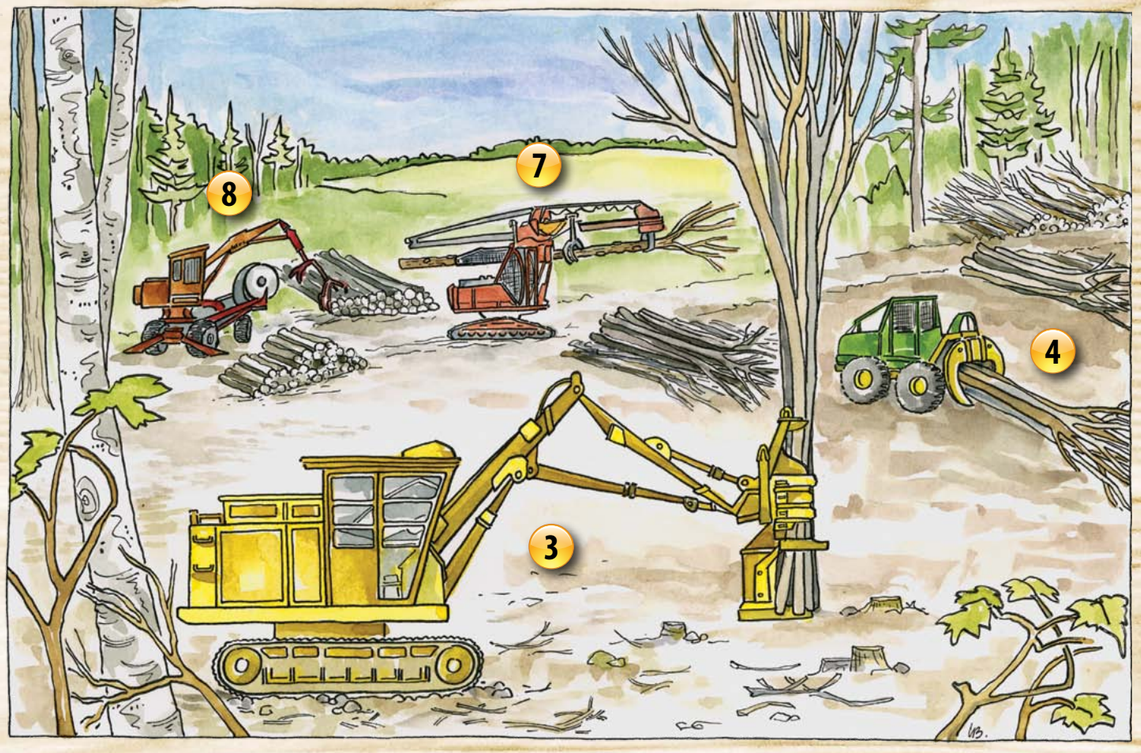
Tree-length logging is the most complex timber harvesting system in Wisconsin. It consists of several specialized pieces of equipment, each performing a single phase of this logging operation but working together in concert. The logging operation begins with the feller-buncher. True to its name, this machine fells trees and places them into bunches. Feller-bunchers are large machines that lift the whole tree after felling it. Placing trees into bunches enhances extraction, the next step of this harvesting system.

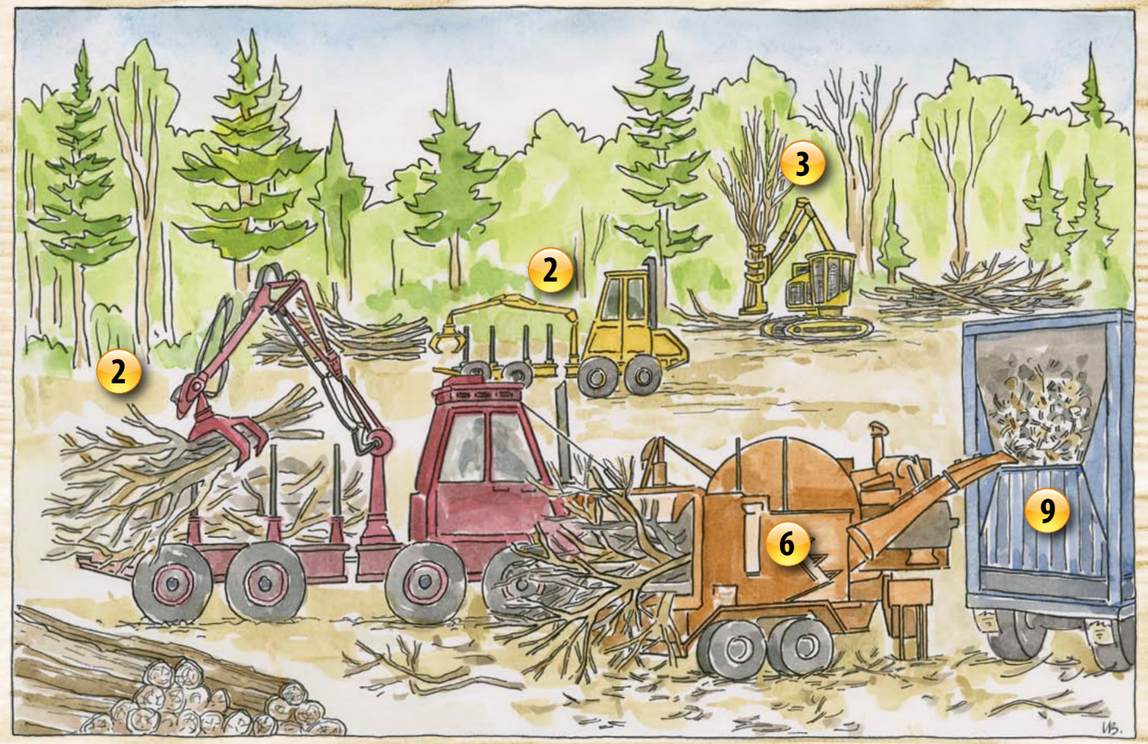
Extraction is accomplished using a grapple skidder. The grapple skidder hooks on to large bunches of whole trees and drags them to the landing. At the landing, a delimber removes the branches from the whole trees, creating tree-length logs. Next, a slasher bucks the tree lengths into sawlogs and pulpwood. Some operations use a single machine called a processor to perform the dual functions of delimbing and bucking.

Landings are the nerve center in a tree-length logging operation. They have to be sufficiently large to accommodate: 1) the skidders, delimber, slasher, loader, and logging trucks that work there, 2) the large pile of slash that accumulates, and 3) the substantial stack of logs and pulpwood produced. Tree-length landings can require considerable post-harvest treatment to remove the concentration of slash and rehabilitate compacted soils. Tree-length operations are best suited to extensive harvest areas (typically 80 acres or more) where most or all of the trees are removed. Examples include clearcuts, seed tree harvests, and shelterwood harvests.

The system works best where the soils can withstand repeated traffic, the terrain is gentle, the harvest blocks are large, and where most of the trees are removed. Landowners can reduce the negative aspects of this harvesting system by having these operations take place only on dry or frozen ground, on gentle slopes, and on soils that can tolerate nutrient removal by slash concentration at the landings.

There is a risk of site degradation with tree-length logging. Whole tree skidding concentrates nutrient-rich slash at the landing rather than distributing slash over the harvest area. This can impact long-term soil fertility on nutrient-poor sites. The skidder operator must also exercise care while transporting whole trees to minimize damage to residual trees.





In-woods chipping looks like other fully mechanized logging operations. Trees are felled by a feller-buncher or feller-processor and transported by grapple skidder or forwarder to the landing. However, this is where the similarity ends. A chipper at the landing converts whole trees into wood chips. Trees are fed into one end of the chipper and clean wood chips are blown out the other end into a chip van. Because chipping involves the harvest and processing of whole trees, very little slash is left in the woods or at the landing. Many landowners like the open appearance of their woodlands following a chipping operation. Additionally, chipping typically results in higher timber revenue because each tree is used completely.

But chipping has its disadvantages. First, it can remove important nutrients from the forest. Most nutrients are concentrated in the leaves, twigs, and small branches of the tree. When this material is left scattered throughout the forest as slash, it decomposes slowly, releasing nutrients back into the soil where they can be taken up by future trees. Chipping interrupts this cycle. Therefore, chipping should be done only on sites where the removal of branches and tops will not negatively impact long-term soil productivity.

Large landings are another disadvantage. Landings must be sufficiently large to accommodate the chipper, the grapple skidder(s) or forwarder(s), whole trees, the chip vans that stream to and from the logging site, and any accumulating bark residues. Also, excessive soil compaction can occur at the landing due to the weight of the equipment and its payload and the high volume of traffic. In the extreme case, expensive rehabilitation may be necessary to restore the landing to its pre-harvest condition.

Not all harvested trees are converted into chips. Instead the logger sets aside the high-valued saw and veneer logs, and feeds the rest through the chipper. This allows the logger and the landowner to maximize the value of the harvested trees.

In-woods chipping is used in clearcut, seed-tree, shelterwood, and heavy thinning operations. It is not used on light, partial harvests where there is potential to damage residual trees. Chipping operations are used more in the central and northern regions where pulp mills use the system's primary output of wood chips. However, this geographic distribution might change in the future given increasing statewide interest in biomass harvesting.

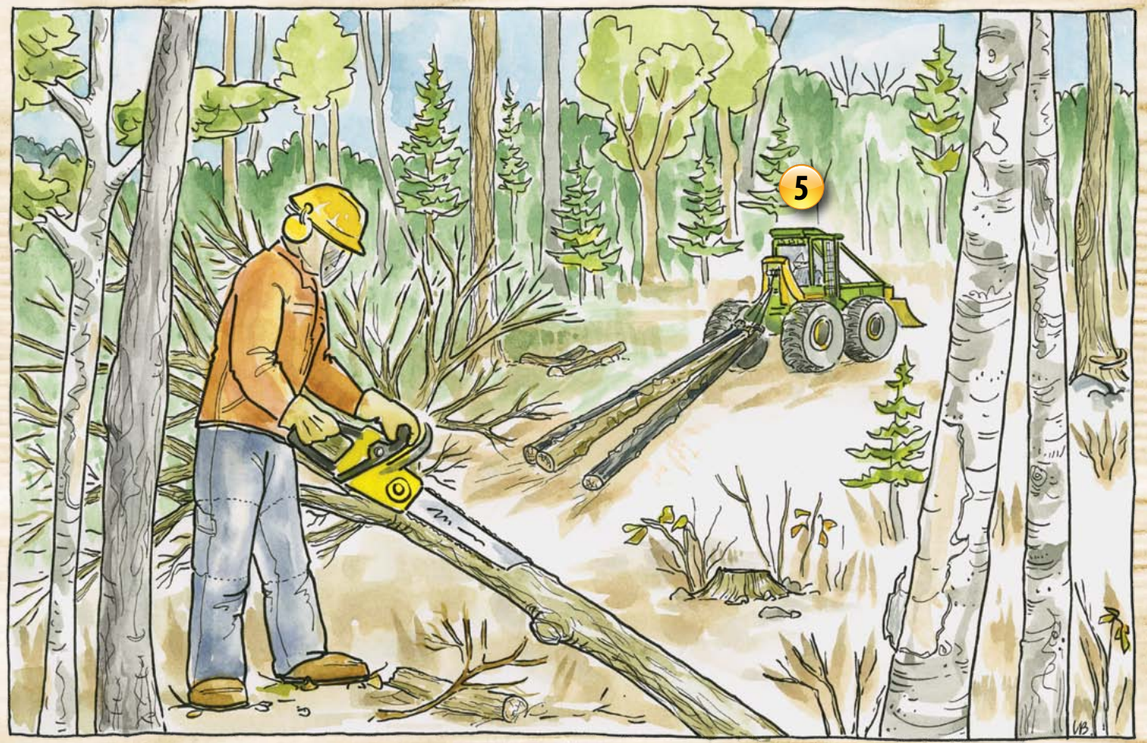
HAND FELLING & FORWARDING

In this system, loggers fell and process trees manually with a chainsaw. A forwarder then carries logs to the landing. The use of manual felling and forwarding has several advantages.

Manual processing occurs at the stump soon after the trees are felled. Therefore slash is left on the forest floor and does not accumulate at the landing. Second, forwarders typically haul larger loads than cable skidders. The higher load capacity allows forwarders to make fewer trips from stump to landing. Consequently, fewer landings might be required and they can be located farther apart. In special cases, the forwarder can load directly onto a logging truck. This eliminates the need for a landing. Third, there is less risk of residual trees being damaged, because forwarders carry and control their loads. Fourth, forwarding often results in improved log quality due to less log breakage and the production of cleaner wood compared to cable skidding.

Hand felling and forwarding is less productive than fully mechanized systems and is not as common in Wisconsin as hand felling and skidding. Forwarders typically require a larger capital investment by the logger and can have higher operating costs. Forwarders can offer improvements in productivity over skidders but are more limited by site characteristics. Also, their larger load capacity can increase the potential for compaction of fine-textured soils such as silts and clays.

This system can implement a wide range of management practices – from selection harvests to clearcuts. However, hand felling and forwarding is best suited to partial timber harvests such as the harvest of large, high-value trees where preserving log quality and stand integrity is a key objective. Another appropriate use is for the first-time thinning of dense pine plantations. In this case, both the size and crowded arrangement of the trees make hand felling and utilizing smaller forwarders suitable.



Hand felling and skidding is a versatile harvesting system. It works in a range of situations, from flat to steep terrain, from partial harvests to clearcuts, from pulpwood to high-quality veneer log harvests. Because the system requires only a chainsaw and a cable skidder, it is characterized by low capital investment and operating costs. However, it has relatively low productivity.

In this system, a logger fells, delimbs, and bucks trees using a chainsaw. Trees or logs are then "skidded" (dragged) using a cable skidder. Equipped with a powerful winch and a cable with wire ropes, called chokers, the skidder winches logs from up to 75 feet away. The operator then drives the skidder and its load to the landing for processing or loading onto trucks. The combination of winch, cable, and chokers allows trees to be extracted from steep slopes, rough terrain, or sensitive areas without the skidder encroaching on these spaces. During a partial harvest, the winch, cable, and chokers can retrieve logs from the remaining standing trees while the skidder stays on a designated trail.

Despite its versatility, hand felling and skidding does have drawbacks. It is among the most dangerous harvesting systems. It is also more affected by inclement weather than fully mechanized systems where the operator works from within an enclosed cab. Dragging wood across the forest floor exposes the soil. While this can be beneficial when it creates ideal conditions for seed germination, it is detrimental when soil disturbance is excessive and erosion occurs. Also, care has to be exercised to avoid damaging the residual trees, particularly when skidding whole trees or tree lengths. Sometimes stems break and dirt accumulates on the skidded stems, reducing the value of logs.

Delimbing typically occurs at the stump, and this distributes slash throughout the forest. Bucking can occur at either the stump or the landing. In-woods processing can be very dangerous for the chainsaw operator because of forest undergrowth and debris. At the landing, the logger will have sound footing and a clear view of each stem. This will also make it easier to obtain the maximum value from the tree, but it can result in an accumulation of slash that might require treatment.

Hand felling and skidding is most prevalent in southern Wisconsin with its large, high-quality trees and steep or rough terrain. In these conditions fully mechanized systems cannot operate as safely, efficiently, or profitably.

HORSE LOGGING

At one time, all timber harvested in Wisconsin was cut by hand and transported by horses or oxen. Today, horse logging occupies a specialty niche among commercial logging operations. This system consists of manual felling and processing at the stump using a chainsaw. Tree lengths or logs are then skidded by horse to the landing.

Horses impose several unique requirements on the logging operation. Felling direction must be precise to facilitate safe and efficient timber extraction. Because slash and high underbrush impede the horse's travel, skid trails must be cleared and delimbing must be thorough.

Horses are more maneuverable than machines. Their low travel speed allows them to carefully negotiate partial harvests with minimal damage to residual trees. Horse logging only works on level to gently rolling terrain, where the slope is 25 percent or less. On steeper ground horses risk being overrun by their load during downhill skids.

Many people perceive horse logging to be environmentally friendly. However, a horse's hooves exert relatively high ground pressure, even higher than many machines. Horses can sometimes cause severe soil disturbance on skid trails where traffic is concentrated. Also, skidded logs can gouge the soil when their leading ends are not lifted off the ground. Skidding when the ground is dry or frozen can help minimize soil disturbance. A light covering of snow improves skidding conditions by protecting the soil surface and reducing friction between the log and the ground.

Horses are quiet and have an aesthetic appeal that gives them a special advantage in certain situations, such as near residential areas. The maneuverability of both the logger and the horse makes this system well suited to partial harvests. However, horse logging has the lowest productivity among the harvesting systems discussed in this publication. Therefore, landowners must typically accept less money for their timber as a trade-off for the benefits of horse logging. There are comparatively few horse loggers in the state and finding one can be difficult.

GLOSSARY OF LOGGING TERMS

Biomass harvest - A harvest designed to capture most of the woody plant material (trunks, branches and tops) in a stand for the production of fuel or energy.

Bucking - Crosscutting tree lengths into logs such as pulpwood, sawlogs or veneer logs, and fuel rods.

Clearcut - The harvest of all commercial trees in an area.

Commercial trees - Trees of suitable species, quality and size that have monetary value to the landowner, logger, and mill.

Forwarding - A method of extraction where the entire load is carried completely off the ground.

Fuel rod - A small diameter log or a log of poor quality that will be converted into fuel or burned to generate energy.

Landing - An area within a timber harvest where felled trees and/or logs are processed, piled, and/or loaded onto trucks for hauling to a mill.

Partial harvest - A timber harvest where only some of the commercial trees are harvested while others are left to continue growing. Examples include thinning, shelterwood, seed tree, and selection harvests.

Pulpwood - A small-diameter log or a log of poor quality that will be made into paper, paperboard, fiberboard or other wood fiber product.

Residual trees - Standing trees that remain on-site following a partial timber harvest.

Sawlog - A large-diameter log of sufficient quality that will be sawn into boards or lumber, usually a minimum of 8 to 12 inches in diameter at the small end depending on the species.

Seed tree harvest - The harvest of all commercial trees in an area except for a few desirable trees that will be left to provide seed for the establishment of a new forest.

Selection harvest - The harvest of individual trees or small groups of trees at periodic intervals (usually 8-15 years).

Shelterwood harvest - The harvest of all mature trees in an area in a series of two or more harvests so seedlings can become established and grow in the partial shade and protection of the older trees.

Skidding - A method of extraction where all or a portion of the load is dragged across the ground.

Slash - Tree branches and tops left on the ground after a logging operation.

Stumpage - Standing merchantable trees or the value of such trees.

Thinning - The removal of some trees from an immature forest to make room for the remaining trees.

Tree length - A felled tree that has had all its branches and top removed, leaving only the main stem.

Veneer log - A large-diameter, high-quality sawlog of desirable species free from defect that will be used to make plywood. Veneer logs are typically the highest valued timber product found in Wisconsin's woodlands.

Whole tree - A felled tree that retains all of its branches and top.

A successful timber harvest involves:

A landowner with clear objectives, obtaining guidance from a professional forester and working in concert with a reputable logger.

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Successful woodland management involves a partnership between landowner, forester and logger. By understanding the timber harvesting equipment and systems loggers use, landowners can select a logging operation that best fits their particular situation and objectives.

This publication describes the six timber harvesting systems most commonly used in Wisconsin. In addition to reviewing this publication, landowners should visit an active logging operation before conducting their own timber harvest so they can see the system at work.

Always work with a professional forester and a professional logger when conducting a timber harvest.

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