Common types of timber harvest systems

Cutting trees, moving logs to a landing and loading logs for transport to a mill are all part of a timber harvest system. It’s the way forest owners supply wood products that everyone uses. It also helps them effectively establish new forests. There are different timber harvest systems. Each one has advantages, which are described below. Modifications can make them even more versatile.

What are the harvest systems?

1. conventional chainsaw and tractor/skidder harvest
2. cable logging
3. shovel logging
4. cut-to-length harvesting
5. whole-tree harvesting
6. helicopter logging

The terrain of your harvest unit will influence your choice of a logging system. On gentle terrain, tree processors and forwarders, excavators, tractors and skidders (explained in the following pages) and even horses can be logical choices. On steep terrain, the choice shifts to cable or helicopter systems,
Conventional chainsaw and tractor/skidder harvest

Hand-operated chainsaws are used to cut, delimb and buck trees into logs at the stumps. Skidders or crawler tractors (dozers) drag the logs to landings, where they are loaded onto trucks.

**Advantages**
- adaptable to smaller harvest locations
- generally less costly equipment

**Equipment used**
- chainsaw
- log skidder or crawler tractor (dozer)
- log loader or self-loading log truck

**Topography considerations**
- normally restricted to slopes less than 35 percent
- haul roads usually located at the bottom of the logging unit

**Soil considerations**
- use of designated skid trails keeps machines on planned routes to help reduce soil disturbance
- on weaker soils, heavy traffic may result in trail ruts that require more water bars after logging
- soil disturbance can be reduced with widely spaced trails and pulling a winch line farther to logs – synthetic lines and other equipment features can make this task easier
- tractors and skidders should lift the front end of logs to reduce soil gouging

**Forest stand considerations**
- provides much flexibility with a variety of stand management goals

**Slash disposal considerations**
- lop and scatter possible with light accumulations of slash
- pile and burn is an option but requires additional steps and costs
- chipping and biomass energy utilization may be possible

**Reforestation considerations**
- yarding traffic or post-logging treatment can scarify ground and create areas for natural regeneration or hand-planting
- some advance regeneration may be lost or damaged by vehicle traffic

**Economic considerations**
- often more labor intensive
- generally, more roads are necessary
- least expensive method if road construction is not needed or is budgeted separately

Left: Skidders or dozers drag logs from the forest to the log landing. To reduce soil disturbance, rubber-tired skidders or crawler tractors are kept on skid trails. Winch line and chokers pull logs to the machine. Right: At the landing, a log loader moves logs onto trucks for delivery to the mill.
Cable logging

On steep terrain, this system uses a steel cable to carry either whole trees or logs to a landing after trees are felled with chainsaws.

**Advantages**
- allows for harvesting on steep ground and other sensitive terrain
- eliminates the need for skid trails
- can reduce construction and less favorable locations of roads

**Equipment used**
- chainsaw
- cable yarder
- delimber and log loader

**Topography considerations**
- well-suited for slopes of 35 percent and greater
- concave slopes allow more cable deflection and greater system efficiency
- intermediate supports allow for log lift in uneven terrain
- haul roads usually located at the top of the logging unit

**Soil considerations**
- can significantly reduce soil compaction and disturbance if logs are properly lifted
- heavy equipment is confined to roads and landings

**Forest stand considerations**
- primarily used with clearcuts and some partial cuts
- a more difficult method for thinning, with potential damage to residual stems

**Slash disposal considerations**
- if whole trees are brought to the landing, in-unit slash is minimized

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**Cable yarding systems can reach out 2,500 feet or more, especially with intermediate cable supports. This can help limit road construction needs.**

- heavy slash piles at the landing must be treated or utilized
- if whole tree yarding is not used, prescribed burning of slash may be needed (see pages 69-72)

**Reforestation considerations**
- may expose fewer spots for easier planting or natural seeding
- brush control needs also may be greater when scarification is reduced

**Economic considerations**
- can be more costly and specialized than ground-based systems
- small-scale systems can be competitive in some situations

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Typical cable harvest layout. Generally logs are pulled uphill, but can also be moved downhill. With a strategic layout, logs can be lifted over streams, wetlands and canyons (see page 63).
Shovel logging

This ground-based harvest system uses a log loader (also called a shovel) to move logs rather than a skidder, tractor or forwarder. The shovel moves logs across the unit to locations near the road where they can be loaded onto log trucks. Logs are often picked up and moved ("swung") several times before reaching the road.

Advantages

• requires few people and machines
• few or no skid trails needed; existing roads may be adequate
• brush can be piled during harvest operations.

Equipment used

• chainsaw
• tracked excavator equipped with a grapple to grip and move logs

Topography considerations

• limited by slope due to machine instability on steep side hills
• may allow for harvest of some sensitive areas, with less disturbance than other systems

Soil considerations

• less compaction and disturbance if machine passes are limited

Forest stand considerations

• used primarily in clearcuts or partial cuts
• requires clearing of roadsides for log decks

Slash disposal considerations

• while moving logs, the excavator can pile heavy concentrations of slash for burning, chipping or other utilization

Reforestation considerations

• while or after moving logs or slash, the excavator can prepare the site for planting or seeding

Economic considerations

• small crew size
• one machine for multiple tasks can reduce costs
• efficiency improves with shorter yarding distances
Cut-to-length harvesting

This ground-based system uses a mechanized harvester (tree processor) and a forwarder. The harvester severs, de-limbs and cuts each tree into logs and stacks them in the forest. The forwarder follows, picking up the logs and carrying loads to log trucks. It is also called a harvester-forwarder system.

Advantages
- leaves slash (tree branches and tops) in the forest
- reduces the need for log landings and access roads

Equipment used
- harvester/processor (tracked or wheeled)
- forwarder (often wheeled)

Topography considerations
- normally limited to slopes less than 35 percent

Soil considerations
- can reduce compaction and disturbance, especially if the processor moves over duff and slash and if forwarders stay on slash-covered, designated skid trails
- slash left in the harvest unit will recycle nutrients and organic matter

Forest stand considerations
- an efficient method for commercial thinning
- typically used to move short logs out of the forest rather than long logs
- processor efficiency in dense stands is useful for forest health and fuels treatments

Slash disposal considerations
- by traveling over and compacting the slash, the system can reduce wildfire hazards and may meet slash hazard control requirements with no further treatment
- equipment can be used for slash piling for burning, chipping or other utilization

Reforestation considerations
- common for thinnings where residual stocking does not trigger reforestation requirements
- if used for heavier cuts and slash loads, extra steps could create spots for planting or seeding

Economic considerations
- may not require new or improved roads
- relatively expensive and specialized machinery and operators
- may require larger volumes or higher quality timber for efficient use
Whole-tree harvesting

This harvest system brings the entire tree, limbs and tops attached, to the landing or roadside. It can be used for both ground-based and cable applications. When used in ground applications, a feller-buncher often is used to cut and pile bundles of trees in the forest. Then a tractor or skidder drags the tree bundles to the landing or roadside. Finally, a delimer converts the trees to logs.

**Advantages**
- can be relatively efficient, including use of smaller material
- slash is brought to the landing or roadside where it can be burned, chipped or otherwise utilized

**Equipment used**
- feller-buncher
- crawler tractor or skidder with grapple
- stroke-boom delimer
- log loader

**Topography considerations**
- normally limited to slopes less than 35 percent
- with ground-based harvest, haul roads are usually at the bottom of the logging area

**Soil considerations**
- vehicles travel over a larger portion of the area as they cut, stack, gather and drag whole trees
- potential for more soil disturbance and compaction than other ground-based systems
- removal of tops and limbs does not recycle nutrients and organic matter near its source

**Forest stand considerations**
- efficient harvest and stand conversion when using a clearcut,
- can be used when thinning, but damage to remaining trees can be a problem.

**Slash disposal considerations**
- slash can be piled and later burned, chipped or otherwise utilized
- slash returned to the harvest area can recycle nutrients and organic matter (see pages 67-69)

**Reforestation considerations**
- widespread traffic and large tree bundles may damage advance regeneration
- dragging tree bundles can expose areas for planting or seeding

**Economic considerations**
- costs can increase on steeper ground or with longer skid distances
- bunching trees can help reduce the cost of handling small diameter trees.
Helicopter logging

This harvest system was once used exclusively for large, high-value timber. Helicopter harvest remains a higher-cost alternative, but it can be used for smaller logs when timber volumes and quality are adequate.

**Advantages**

- can harvest visually sensitive, inaccessible or other areas where other systems are unsuitable
- useful option for locations with high recreational use, special wildlife habitat, riparian/wetlands or geologic hazards
- may reduce or avoid new road construction, including hazardous/sensitive locations

**Equipment used**

- chainsaw
- logging helicopter
- helicopter maintenance and fueling equipment
- log loader

**Topography considerations**

- can be used on any type of terrain with suitable landing and helicopter service area locations (i.e., adequate size, safety and efficiency)

**Soil considerations**

- minimizes in-unit soil disturbance and compaction because logs are fully suspended
- large landings and service areas may require extra drainage or other treatment

**Forest stand considerations**

- offers efficient, but costly method for commercial thinning
- large landings and service areas can locally impact forest stands.

**Slash disposal considerations**

- lop-and-scatter methods typically are used to reduce fire hazards
- if further treatment is needed, it can be costly where road access is limited

**Reforestation considerations**

- slash left on-site and limited yarding disturbance result in fewer exposed spots for easy planting or natural seeding

**Economic considerations**

- typically the most expensive logging system
- equipment and crew needs can result in costs three to four times those of ground-based systems
- reduced road construction needs may help offset high costs
- without adequate volume of higher value logs, harvest costs may exceed timber revenues