TERMINOLOGY OF GROUND-BASED MECHANIZED LOGGING IN THE PACIFIC NORTHWEST

by

Loren D. Kellogg
Pete Bettinger
Don Studier
The Forest Research Laboratory of Oregon State University was established by the Oregon Legislature to conduct research leading to expanded forest yields, increased use of forest products, and accelerated economic development of the State. Its scientists conduct this research in laboratories and forests administered by the University and cooperating agencies and industries throughout Oregon. Research results are made available to potential users through the University’s educational programs and through Laboratory publications such as this, which are directed as appropriate to forest landowners and managers, manufacturers and users of forest products, leaders of government and industry, the scientific community, and the general public.

The Authors

Loren Kellogg is associate professor and Pete Bettinger is faculty research assistant in the Forest Engineering Department, Oregon State University, Corvallis, Oregon. Don Studier is program manager in the USDA Forest Service, Pacific Northwest Research Station, Corvallis, Oregon.

Acknowledgments

This guide to terminology was developed in response to participants’ requests at a workshop entitled Mechanized Harvesting: The Future is Here (December 17-19, 1991), held by the Department of Forest Engineering, Oregon State University. The diagram of the cone felling head is adapted from a figure used with permission from EXCO Industries, Ltd., 100 Mile House, B.C., Canada. The diagram of bogie wheels is adapted from a figure used with permission from the Forest Engineering Research Institute of Canada, Vancouver, B.C., Canada. Diagrams illustrating the auger felling head, chain-and-bar felling head, continuous circular-saw (disk-saw) felling head, and shear felling head are adapted from figures used with permission from SAE J1272©, 1985, published by Society of Automotive Engineers, Inc. Adaptations are by G. Bracher. L. Haygarth created most of the other illustrations in this report.

To Order Copies

Copies of this and other Forest Research Laboratory publications are available from:

Forestry Publications Office
Oregon State University
Forest Research Laboratory 227
Corvallis, Oregon 97331-7401

Please indicate author(s), title, and publication number if known.
TERMINOLOGY OF GROUND-BASED MECHANIZED LOGGING IN THE PACIFIC NORTHWEST

by

Loren D. Kellogg
Pete Bettinger
Don Studier
# Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>1</td>
</tr>
<tr>
<td>Machinery and Operations</td>
<td>1</td>
</tr>
<tr>
<td>Logging Systems</td>
<td>7</td>
</tr>
<tr>
<td>Literature Cited</td>
<td>8</td>
</tr>
<tr>
<td>Index (by Process)</td>
<td>10</td>
</tr>
</tbody>
</table>
Introduction

The history of mechanized logging in the Pacific Northwest is relatively short, but the interest in mechanized logging operations is increasing due to escalating labor rates and a shift from old-growth harvesting to second-growth logging (Kellogg et al. 1992). In the Pacific Northwest, mechanized harvesting of small trees on terrain with slopes of 30 percent or less is typically performed by feller-bunchers, which fell and bunch trees, and grapple skidders, which skid the bunches of whole trees to landings for processing into logs or chips by mechanical processors. There are variations to the “whole-tree method” in terms of machines and methods of operation. There are also other mechanized logging systems used in the Pacific Northwest which differ distinctly from the “whole-tree method.” The “cut-to-length method” and the “tree-length method” are examples.

The purpose of this publication is to compile a standardized set of terminology for mechanized logging machinery and logging methods for the Pacific Northwest. While other organizations have produced similar works with either a wider or narrower focus (Dean and Evans 1978, Mifflin and Lysons 1979, Ford-Robertson 1983, Granvik et al. 1983, American Society of Agricultural Engineers 1991, Society of Automotive Engineers, Inc. 1991), this publication is limited to mechanized logging equipment and logging methods. Terminology from Scandinavian and Canadian organizations, the Food and Agriculture Organization of the United Nations, and various U.S. organizations was compiled and synthesized into the terminology that follows. The publication is divided into sections on machinery and operations and on logging systems.

Machinery and Operations

**Articulated Steering:** With reference to a vehicle, hinged at the center for turning, as with a wheeled skidder (Stokes et al. 1989).

**Auger Felling Head:** A non-shear felling head with which felling is achieved by the action of a rotating horizontal cylindrical auger; this auger has fluted cutters on the circumference that cut toward an anvil (Society of Automotive Engineers, Inc. 1992). The auger passes entirely through the tree, at which time it retracts to a position within the felling head (McMorland 1980).

**Bogie Wheels:** Tandem axles driven by a single differential, used to provide lower ground pressure than single axles because more tire surface is in contact with the ground, creating a better distribution of the wheel load (Makkonen 1989). Half-tracks are sometimes stretched around bogie wheels to provide better traction and weight distribution (J. Starnes, USDA Forest Service, Lakewood, Colorado, personal communication, 1992).

**Buck:** Crosscutting a felled tree into log segments (Stokes et al. 1989, S. Pilkerton, OSU Forest Engineering Department, Personal communication, 1992).
Chain-and-Bar Felling Head: A non-shear felling head with which felling is achieved by a saw-bar-and-chain that travels from one side of the head to the other. Once cutting is complete, the saw-bar-and-chain retracts to a position within the base of the felling head (McMorland 1980).

Chain-Flail Delimber: A machine that delimbs trees through impact and by scraping with a rotating drum with rows of short chains attached. Usually mounted on the front end of a rubber-tired vehicle that is driven over piles of trees on the ground (Kellogg et al. 1992).

Chain-Flail Delimber/Debarker: A machine that delimbs and debarks trees through impact and by scraping with two or three rotating drums with rows of short chains attached (Kellogg et al. 1992).

Chipper: A machine equipped with rotating disk-mounted or drum-mounted knives that mechanically reduce logs or whole trees to small pieces or chips of more-or-less uniform dimension (Kellogg et al. 1992), normally 3/16 to 1-1/8 inches (4.8 to 28.6 mm) long (Blackstock 1964). Often there is a grapple for self-loading material into the chipper.

Choker (Line or Cable) Skidder: A four-wheel-drive rubber-tired tractor with articulated steering and a range of horse-power classes (Ford-Robertson 1983, Stenzel et al. 1985, pp. 339-351). Equipped with single or double winches that contain wire rope and wire rope chokers to assemble and hold the load (Society of Automotive Engineers, Inc. 1991).

Chunker: A portable machine equipped with a spiral-head chipper (spiral-cutter blade mounted on a rotating shaft) or an involuted single-disk chipper (chipper blades mounted on the face of a thick steel disk) (Arola et al. 1988). Designed to chunk trees or parts of trees (American Society of Agricultural Engineers 1991) into wood fragments longer and wider than conventional chips (USDA Forest Service 1991) and generally 2 to 4-1/2 inches (50.8 to 114.3 mm) long in the fiber direction (Arola et al. 1983).

Clam-Bunk Skidder: An articulated rubber-tired or tracked vehicle for transporting whole trees by supporting the butt end clear of the ground in a top-opening log bunk (inverted grapple). Clam-bunk skidders are equipped with a grapple loader for self-loading (Kellogg et al. 1992).
Cone Felling Head: A non-shear felling head with which felling is achieved by the action of a slowly rotating cone. The felling head is placed on a tree, the tree is firmly grabbed, and the cone is activated, cutting its way through the tree because of the increasing taper of the cone. The cone is limited to one revolution but does not necessarily have to perform a full revolution. After cutting, the cone retracts to a resting position (Folkema 1984).

Continuous Circular-Saw (Disk-Saw) Felling Head: A non-shear felling head with which felling is achieved by a horizontal disk. The cutting teeth on some disks are cone-shaped and easily replaced. The head relies on the inertial energy and large mass of the disk to propel the disk through the tree, and the tree is grabbed by the head after felling is completed (Greene and McNeel 1989).

Crane Processor: See Grapple Processor.

Crosscut (Buck): To cut wood across the grain (Stokes et al. 1989).

Debarker: A machine used to remove bark from logs prior to processing them into lumber or plywood (Dean and Evans 1978). Debarkers are typically used at the mill site.

Delimber: A self-propelled or portable machine designed to remove limbs from trees (American Society of Agricultural Engineers 1991). This function is commonly combined with other in-woods functions such as topping, crosscutting (bucking), and deckin.

Double-Grip Harvester: A machine with which felling is performed by a boom-mounted unit that works in combination with a processing unit for delimming and bucking. Mounted on the base carrier (Kellogg et al. 1992).

Feller-Buncher: A machine for the mechanical felling of trees with a shear or saw device. Some feller-bunchers accumulate several small trees before the bunch is placed in a selected...
position. Configurations include rubber-tired and tracked drive-to-tree machines, tracked swing-boom machines, and tracked leveling swing-boom machines for steep terrain (Kellogg et al. 1992).

**Feller-Chipper**: A machine designed to fell and chip whole trees (Society of Automotive Engineers, Inc. 1991). The felling and chipping components are mounted on a mobile vehicle, where felled trees and residues are fed into a chipping drum as the machine moves forward and the chips are blown into a mobile chip forwarder (Vasievich and Croll 1981).

**Feller-Director**: A machine for the mechanical felling of trees. Equipped with a shear or saw and a hydraulic device for controlling the direction of fall of the tree. Feller-directors usually handle one tree at a time, and can fell larger trees than a feller-buncher of equivalent size (Kellogg et al. 1992). However, they do not have the capability to hold a felled tree in a vertical position (J. Starnes, personal communication, 1992).

**Feller-Forwarder**: A machine for felling and transporting whole trees clear of the ground in a load cradle on the rear chassis. Equipped with a boom-mounted shear or saw felling device (Food and Agriculture Organization of the United Nations 1977, Kellogg et al. 1992).

**Feller Head**: A head that attaches to the feller-buncher and consists either of a shear, continuous circular saw, intermittent circular saw, cone, auger, or chain and bar (see separate definition for each feller head).

**Feller-Skidder**: A machine—essentially a Clam-Bunk Skidder—on which the loading grapple has been replaced by a felling head (Food and Agriculture Organization of the United Nations 1977).

**Fifth Wheel**: A weight-bearing swivel mounted over the driving axles of a truck tractor. Used to attach a trailer (Stokes et al. 1989).

**Forwarder**: A rubber-tired, articulated vehicle used for transporting shortwood or cut-to-length logs clear of the ground. The forwarder is equipped with a grapple loader for loading and unloading (Kellogg et al. 1992).

**Front-End Log Loader**: A wheeled or track machine capable of using hydraulic forks on the front end for lifting a log or load of logs clear of the ground. Used to load the material on trucks at the landing or to off-load logs at the mill site (Kellogg et al. 1992).

**Grapple Processor**: A machine that delims, tops, and bucks whole trees at the landing or in the woods. This machine supports the tree in a boom-mounted processor, which pulls the tree through stationary
Grapple Processors are typically equipped with length- and diameter-measuring devices (Kellogg et al. 1992) and are sometimes referred to as crane processors.

**Grapple Skidder:** A four-wheel-drive rubber-tired tractor with articulated steering for transporting a load by lifting the log ends clear of the ground in a grapple (Kellogg et al. 1992).

**Grinder:** A portable machine designed to grind wood into fine particles (American Society of Agricultural Engineers 1991).

**Half-Track:** A vehicle moved by a pair of short, endless articulated belts, called tracks, driven by tractor tires. Steering is by a pair of ordinary wheels in front. The whole vehicle is termed a half-track (Stokes et al. 1989).

**Harvester:** A machine that fells, delimbs, tops, and crosscuts (bucks) the tree at the stump area. Configurations include single-grip and double-grip machines. Multi-function harvesters are equipped with a boom-mounted felling device, and sometimes have the ability to transport the material to the landing (Kellogg et al. 1992).

**Harvester-Forwarder:** A self-propelled machine designed to fell, delimb, crosscut, and carry tree parts to a landing (Society of Automotive Engineers, Inc. 1991).

**Hogger:** Portable machine designed to produce coarse chips, typically for use as fuel (American Society of Agricultural Engineers 1991) and for the manufacture of wood pulp and chipboard (Ford-Robertson 1983).

**Hydraulic Grapple Loader:** A loading device capable of lifting a log or tree clear of the ground. Consists of a boom and a hydraulic grapple mounted on a mobile carrier (Kellogg et al. 1992).

**Intermittent Circular-Saw (Disk-Saw) Felling Head:** A non-shear felling head with which felling is achieved by a horizontal disk. The head relies on high torque to sever the tree, and the disk is activated only when the felling machine is at the tree to be cut (Greene and McNeel 1989).

**Landing:** Any place where timber is assembled for further transport, commonly associated with a change of transport method (Ford-Robertson 1983) from primary to secondary. Landings are either centralized or continuous locations along the road, referred to as roadside landings (J. Starnes, personal communication, 1992).

**Loader-Mounted Self-Aligning Delimber:** A machine with a pivotally mounted, self-aligning delimbing head that lines up with the tree stem as it is pulled through the head by a hydraulic log loader (Starnes 1991).

**Log Bunk:** A cross beam on a log trailer or truck on which the logs rest (Stokes et al. 1989).
**Primary Transportation**: Movement of a felled tree, or tree parts, from the stump to a landing (Stokes et al. 1989).

**Processor**: A self-propelled or portable machine used at the landing or in the stump area; it performs one or more processing functions, such as delimming, topping, and crosscutting, but does not fell trees (Granvik et al. 1983). See **Grapple Processor** or **Stroke-Boom Delimber** for specific types of processors.

**Secondary Transportation**: Movement of wood from the landing to another point (centralized woodyard, mill, etc.) by truck, rail, or water (Stokes et al. 1989).

**Shear Felling Head**: A felling head that forces one or more shear blades through the tree by hydraulic pressure (Starnes 1991).

**Shredder**: A drum-type chipper for processing limbs, bark, small trees, and other woody biomass into hogged fuel (Lambert and Howard 1990, pp. 35-37). The machine may also be equipped with free-swinging flails that shred slash into very fine material (McKenzie and Makel 199). See **Grapple Processor** or **Stroke-Boom Delimber** for specific types of processors.

**Single-Grip Harvester**: A machine that both fells and processes (delims and crosscuts) with a single boom-mounted unit (Kellogg et al. 1992).

**Slasher (Bucker)**: A machine used at the landing or mill yard to buck trees or tree parts (singly or in multiples) to predetermined lengths (Granville et al. 1983).

**Splitter**: A portable machine designed to divide trees or parts of trees longitudinally (American Society of Agricultural Engineers 1991).

**Stroke-Boom Delimber**: A machine that delims, tops, and bucks whole trees at the landing or in the woods. Stroke-boom delimiters process a tree by holding it in stationary arms while pushing a knife-edged sliding grapple along the stem. Configurations include one-piece and telescopic booms. All are equipped with length-measuring devices, and some also have diameter-measuring devices (Kellogg et al. 1992).

**Stroke-Deck Delimber**: A machine that delims, tops, and bucks trees at the landing or roadside. Stroke-deck delimiters support the tree on a deck while a deliming grapple is pulled along the stem. These machines are equipped with length- and diameter-measuring devices (Kellogg et al. 1992).

**Truck Train**: A truck with two or more log trailers. A configuration used in Cut-to-Length logging is called a B-train. The B-train is a combination of two trailers, with the fifth wheel of the first trailer
mounted behind the rear axles to reduce off-tracking (in which the rear wheels do not follow the tracks made by the front wheels when rounding a curve). The first trailer normally holds one or two log bunks, while the second trailer normally holds one bunk (J. Starnes, personal communication, 1992).

**Wire Rope Crane-Type Loader:**
A loading device mounted on a mobile carrier. Commonly called a heelboom loader. It is similar to the grapple loader, except that the grapple mechanism is cable-controlled (Kellogg et al. 1992).

---

**Logging Systems**

The mechanized equipment previously defined can be combined in various logging systems. These logging systems encompass a combination of equipment and people. Their names describe a specific condition and length of the logged timber transported to the landing or the mill site. The major logging systems covered are whole-tree, tree-length, and cut-to-length. Other terms for systems are described as subcategories within one of the three major systems. Figure 1 illustrates the various processes of these systems at the stump, for primary transportation, and in landing operations.

**Whole-Tree:** Harvesting systems that deliver trees to the landing with limbs and tops attached to the stem.

**Tree-Length:** The whole tree is cut into sections, and the unlimbed raw material

---

![Diagram of Truck Train](image-url)
is hauled to the pulp mill by truck instead of being chipped at the landing site (Hakkila 1989).

**Tree-Length:** Harvesting systems that deliver delimbed and topped tree stems to the landing (Food and Agriculture Organization of the United Nations 1977).

**Cut-to-Length:** Harvesting systems in which trees are delimbed and bucked into sorted piles at the stump prior to subsequent transport to the landing by skidding or forwarding (Hakkila 1989).

- **Leave-Top-Attached:** The tree top is left attached to the top log and transported to the roadside rather than being left at the stump.

- **Log-Length:** The log lengths are variable and generally greater than 20 feet (6.1 m).

- **Shortwood:** Logs are forwarded to landings and off-loaded to the ground or directly onto trailers. Depending on specific forwarder capabilities, maximum log lengths are usually limited to 5-20 feet (1.5-6.1 m). The term shortwood method is commonly used for pulpwood operations in which piece sizes are 8 feet (2.4 m) or less.

**Literature Cited**


Index (by Process)

**Felling**

- Double-Grip Harvester ................................................................. 3
- Feller-Buncher ............................................................................. 3
- Feller-Chipper ............................................................................. 4
- Feller-Director ............................................................................. 4
- Feller-Forwarder ......................................................................... 4
- Feller Head.................................................................................. 4
  - Auger Felling Head .................................................................. 1
  - Chain-and-Bar Felling Head ....................................................... 2
  - Cone Felling Head .................................................................... 3
  - Continuous Circular-Saw (Disk-Saw) Felling Head ................. 3
  - Intermittent Circular-Saw (Disk-Saw) Felling Head ................. 5
  - Shear Felling Head .................................................................. 6
- Feller-Skidder ............................................................................. 4
- Harvester ................................................................................... 5
- Harvester-Forwarder ................................................................... 5

**Machine Components**

- Articulated Steering .................................................................... 1
- Bogie Wheels ............................................................................... 1
- Half-Track ................................................................................... 5
- Single-Grip Harvester ................................................................ 6

**Primary Transportation**

- Choker (Line or Cable) Skidder ................................................... 2
- Clam-bunk Skidder ................................................................... 2
- Feller-Forwarder ......................................................................... 4
Feller-Skidder ................................................................. 4
Forwarder ........................................................................ 4
Grapple Skidder .............................................................. 5
Harvester-Forwarder ....................................................... 5

Machine Components

Articulated Steering .......................................................... 1
Bogie Wheels ................................................................. 1
Half-Track ....................................................................... 5
Log Bunk ....................................................................... 5

Processing

Chain-Flail Delimber .......................................................... 2
Chain-Flail Delimber/Debarker ........................................... 2
Chipper ............................................................................ 2
Chunker .......................................................................... 2
Crane Processor .............................................................. 3
Debarker ........................................................................ 3
Delimber ......................................................................... 3
Double-Grip Harvester ................................................... 3
Feller-Chipper ................................................................. 4
Grapple Processor ............................................................ 4
Grinder .......................................................................... 5
Harvester ....................................................................... 5
Harvester-Forwarder ....................................................... 5
Hogger .......................................................................... 5
Loader-Mounted Self-Aligning Delimber ........................... 5

Machine Components

Articulated Steering .......................................................... 1
Bogie Wheels ................................................................. 1
Half-Track ....................................................................... 5
Processor ....................................................................... 6
Shredder ........................................................................ 6
Single-Grip Harvester ..................................................... 6
Slasher (Bucker) ............................................................... 6
Splitter .......................................................................... 6
Stroke-Boom Delimber .................................................. 6
Stroke-Deck Delimber ..................................................... 6

11
Loading

Feller-Chipper ................................................................. 4
Feller-Forwarder .............................................................. 4
Forwarder ........................................................................ 4
Front-End Log Loader ....................................................... 4
Harvester-Forwarder ......................................................... 5
Hydraulic Grapple Loader .................................................. 5
Loader-Mounted Self-Aligning Delimber .............................. 5
Wire-Rope Crane-Type Loader ............................................ 7

Secondary Transportation

Fifth Wheel ........................................................................ 4
Truck Train ......................................................................... 6

Logging System

Whole-Tree ....................................................................... 7
   Total-Tree ....................................................................... 7
   Tree-Section ................................................................... 7
Tree-Length ....................................................................... 8
Cut-to-Length .................................................................... 8
   Leave-Top-Attached ........................................................ 8
Log-Length ....................................................................... 8
Shortwood ....................................................................... 8

Miscellaneous

Buck ............................................................................... 1
Crosscut (Buck) ................................................................. 3
Landing ........................................................................... 5

Terminology is defined for mechanized harvesting equipment and logging systems applicable to the Pacific Northwest.
As an affirmative action institution that complies with Section 504 of the Rehabilitation Act of 1973, Oregon State University supports equal educational and employment opportunity without regard to age, sex, race, creed, national origin, handicap, marital status, or religion.