

Unit D: Forest Products

Lesson 3: Processing Forest Products

Student Learning Objectives: Instruction in this lesson should result in students achieving the following objectives:

1. Explain the harvesting and the logging plan of forest products.
2. Identify the logging activities.
3. Describe the processing of forest products.

Recommended Teaching Time: 3 hours

Recommended Resources: The following resources may be useful in teaching this lesson:

- A PowerPoint has also been developed with use of this lesson plan
- http://en.wikipedia.org/wiki/Wood_processing

List of Equipment, Tools, Supplies, and Facilities

Writing surface
PowerPoint Projector
PowerPoint slides
Transparency Masters
Samples of wood products

Terms: The following terms are presented in this lesson (shown in bold italics and on PowerPoint Slide #2):

- Bucking
- Bull chain
- Cants
- Cooperage
- Felling
- Fuelwood
- Green chain
- Jack ladder
- Kraft
- Limbing
- Loading
- Oriented Strand Board (OSB)
- Plywood
- Skidding
- Veneer

Interest Approach: Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

Have different samples of wood products for student observation. Ask students where the products came from and what procedures are involved in producing the final product. Direct the discussion to introduce the lesson.

Summary of Content and Teaching Strategies

Objective 1: Explain the harvesting and the logging plan of forest products.

(PowerPoint Slide #3)

I. Harvesting or logging has been called the key to forestry.

- A. The best silvicultural plans are executed through the proper use of logging. The productivity of timber stands can be virtually destroyed by poorly planned or careless logging.

(PowerPoint Slide #4)

1. The cost of logging is a major factor in the production of wood products. Timber is heavy, hard and difficult to handle.

(PowerPoint Slide #5)

- a. Logging costs are high, so efficient and economical harvesting is essential to sustained forest management yield. As a result of the rising costs logging must be carefully planned and integrated with silvicultural and forest protection activities. The logging plan should be a part of the total forest management plan.

(PowerPoint Slide #6)

- b. A logging plan may be as comprehensive as the forest management plan. Some of the general points of a logging plan are:
1. The location of cutting boundaries of the stand to be cut.
 2. The marking of the timber to be harvested (except when all the timber is to be cut).

(PowerPoint Slide #7)

3. The cruise of timber to be removed. A cruise estimates timber volume by species and products, timber size, and location.
4. The location of the most efficient log-loading sites.
5. The location of skid trails and haul roads.
2. The marking of the timber to be harvested (except when all the timber is to be cut).

(PowerPoint Slide #8)

6. The description of equipment to be used and the type of logging to be done; such as, short logs, long logs, or tree lengths.
7. The location of emergency equipment storage points, including firefighting tools, first-aid containers, and other emergency equipment.

Objective 2: Identify the logging activities.

****Before beginning this objective ask the students what steps are involved in logging, beginning to end. Have them create a logical order for these steps.**

(PowerPoint Slide #9)

II. Logging is considered a dangerous occupation.

(PowerPoint Slide #10)

A. The activities associated with logging require persons skilled in woods work and the operation of logging equipment.

1. Logging activities involve (1) cutting the trees, (2) removing the limbs (limbing), (3) cutting the trees into lengths, and (4) either skidding the logs to a central point for loading or loading pulpwood bolts at the general cutting area.

(PowerPoint Slide #11)

- a. Each of these operations require special skills and equipment. Because of rising labor costs, equipment is utilized over labor whenever possible.

(PowerPoint Slide #12)

2. **Felling** is the act of cutting or severing a tree from its stump. It involves cutting the tree in such a way that it safely falls in the desired direction and results in the least damage to the tree and surrounding trees.

(PowerPoint Slide #13 shows a picture of a tree feller)

(PowerPoint Slide #14)

3. **Limbing** is cutting branches off either felled or standing trees.
4. **Bucking** or cutting to length is cutting the felled trees into log or bolt lengths. The length of the log is dependent on the tree species and the desired final product.

(PowerPoint Slide #15)

- a. Important factors affecting the felling and cutting-to-length operations.
 1. The volume per hectare and size of timber to be cut.

(PowerPoint Slide #16)

2. The skill of logging crews.
3. The condition of the terrain; the amount of brush, the steepness of the land, and the wetness or dryness of the site.
4. The amount of defect in the timber.
5. The season of the year.

(PowerPoint Slide #17)

5. **Skidding** is the part of the logging operation in which the logs are dragged from where they were cut to length to a central location for loading onto trucks.

(PowerPoint Slide #18)

- a. Factors involved in skidding are similar to those involved in felling or cutting to length with the following exceptions:
 1. The difference in weight of logs.
 2. The distance to skid.
 3. The amount of time required prior to skidding to bunch logs.

(PowerPoint Slide #19)

6. **Loading** is lifting logs or bolts from the ground and placing them on trucks or trailers.
- Care is taken to compact the load so that it will withstand the jostling action during hauling.

(PowerPoint Slide #20)

- Small pulpwood bolts are loaded by hand.
- Large logs are loaded with a drum-powered cable wench on trucks, hydraulic cranes, front-end hydraulic loaders, large cable cranes and cables attached to the tractor skidders.

(PowerPoint Slide #21 shows a picture of loading logs)

(PowerPoint Slide #22 shows a picture of pulpwood loaded up)

(PowerPoint Slide #23)

7. Most logs and bolts are hauled from the woods by trucks to a wood-using mill or where they are reloaded for shipment to a distant mill.
- Every size and type of truck manufactured is used to haul bolts and logs.

(PowerPoint Slide #24)

8. New logging equipment, called whole tree chipper system, cuts and chips the whole tree and hauls the chips to pulp and paper mills, building board plants, cedar oil mills, and other units that use tree chips in their manufacturing processes.

(PowerPoint Slide #25 shows pictures of manufactured wood material)

(PowerPoint Slide #26)

- Machines are also being used to lift the entire tree from the ground. The advantage of removing the entire tree is that the stump and roots, which are normally wasted, are utilized along with the above-ground portion of the tree.

****Use TM: D3-1, TM: D3-2, TM: D3-3, TM: D3-4, TM: D3-5, TM: D3-6, and TM: D3-7 as material for lecture and discussion. Lead into a discussion about where the wood goes to after it has been loaded in Afghanistan. Do you process it somewhere? Does the wood get exported?**

Objective 3: Describe the processing of forest products.

(PowerPoint Slide #27)

III. Once logs or bolts reach a wood-using firm, they may be debarked, sawed, shaped, peeled, cooked, burned, glued, or dried.

(PowerPoint Slide #28)

- A. These treatments result in the production of lumber, paper, plywood, building boards, poles and piling, railroad cross-ties, fence posts, furniture, handles, charcoal, and a large variety of other products.

(PowerPoint Slide #29 shows examples of saw log material)

(PowerPoint Slide #30)

- When logs arrive at a sawmill, they are generally stored until needed for processing. At fully integrated operations, tree-length logs are utilized according to their most efficient use.

(PowerPoint Slide #31)

- From the storage deck, logs are moved by bull chains, jack ladders or rolled into the mill.
 - A **bull chain** is a chain device used to pull logs up into the saw mill.
 - A **jack ladder** is another version of the bull chain and it can look like a ladder.

- c. At larger mills, the logs are debarked prior to entering the mills so that slabs and edgings may be hogged or chopped into pulp chips.

(PowerPoint Slide #32)

3. The logs are rolled one at a time onto a carriage or holding device for sawing. A mill worker, called a sawyer, controls the headsaw to get the most and best lumber from each log.
 - a. The headsaw removes slabs (outer portions of the logs) to reduce log cylinders into **cants**, a squared-off log made by cutting off the rounded portion of the log.

(PowerPoint Slide #33)

- b. The headsaw reduces the cants into boards and smaller cants that move into a gangsaw or resaw. Cants can then be cut into lumber of specific sizes by gangsaws or resaws.

(PowerPoint Slide #34)

4. The saws of the edger cut boards (2.5 cm lumber) and dimensions (5 cm plus lumber) are cut into proper widths.

(PowerPoint Slide #35)

5. The trimmer cuts the lumber into proper lengths. From the trimmer, the lumber is carried by a green chain into a long shed for sorting.
 - a. A **green chain** is a system of moving rollers that carry the freshly cut lumber (green, unseasoned lumber) from the saws.

(PowerPoint Slide #36)

6. Workers pick the lumber off the green chain and sort it according to size.
7. Experts grade the lumber according to specifications for quality adopted by the lumber manufacturing industry.

(PowerPoint Slide #37)

8. The lumber may be stacked in the yard for air-drying or loaded onto special cars for entry into dry kilns. In kilns, the lumber is rapidly seasoned under controlled conditions to reduce the moisture to levels suitable for the area in which the lumber will be used.

(PowerPoint Slide #38)

9. Some mills have planning units that surface or smooth the rough lumber. In this case the grading takes place after surfacing.
10. The sawdust is conveyed to a storage bin and will eventually be sold to pulp and paper mills.

(PowerPoint Slide #39)

11. Innovations of automating sawmill operations:
 - a. At very high rates of speed, electronic sorters automatically stack the lumber by size.
 - b. Closed-circuit TV allows machine operators to control equipment that is hundreds of feet away.

(PowerPoint Slide #40)

- c. X-ray machines and computers scan logs and instantly decide the most profitable way for headsaws to cut them.
 - d. Computerized headsaws boost rough lumber recovery to 60 percent.
 - e. Thin saw blades reduce sawdust volumes by 5 percent.

(PowerPoint Slide #41)

- f. Laser beams and water-jet headrigs may eliminate most sawdust and the need for some lumber planing.

- g. Electro-mechanical machines can measure the stiffness and strength characteristics of individual pieces of lumber. The lumber can then be stamped a strength value and marketed as stress rated or stress graded.

(PowerPoint Slide #42)

B. Paper has been around for about 2,000 years. Cooking wood fiber in a chemical solution is the most widely used method of making pulp.

(PowerPoint Slide #43)

1. When pulpwood bolts or logs arrive at a mill, they are stored in huge piles for later use.
 - a. From the stacks, the pulpwood moves by conveyors to debarking machines, where the logs are tumbled together in huge drums or sprayed with high pressure jets to remove the bark.

(PowerPoint Slide #44)

- b. The bolts move to large chippers that slice off small wood chips for the chemical process or to large, coarse grindstones that reduce the bolts to short fibers for the ground wood process; the latter method is used to make much of the country's newsprint.

(PowerPoint Slide #45)

2. To make paper, the cellulose must be chemically separated from the lignin binder by cooking the wood in sulfite, soda or sulfate solutions.

(PowerPoint Slide #46)

- a. This done in digesters or huge pressure cookers, where the wood and the chemicals are cooked under steam pressure that reduces the whole to a mass of wet pulp. The chemicals are removed and the pulp is thoroughly washed.

(PowerPoint Slide #47)

- b. From this stage, the wood pulp goes through beaters that separate the individual fibers. Often sizing (for smoothness and water resistance), bleach, and color are added during this process.

(PowerPoint Slide #48)

- c. In the final step, the wet pulp enters the Fourdrinier paper machine. The pulp is sprayed onto a wire screen that allows the wood fibers to interlace while the water is drawn off.

(PowerPoint Slide #49)

- d. From the screen, a continuous mat of wood pulp moves onto a belt of wool felt and then through a series of rollers that press more water out. The material then moves into the dry end of the Fourdrinier through a series of heated rollers called dryers.
 - e. Finally, the finished product is wound into rolls that vary in width and weight.

(PowerPoint Slide #50)

3. Paper mills turn out a variety of materials, from raw pulp, to gift-wrapping paper, newsprint, magazine and book stock, writing paper, milk carton stock, bond, wax paper, and kraft.
 - a. **Kraft** is the paper made into brown paper grocery bags, cardboard boxes (called liner board) and similar products.

(PowerPoint Slide #51)

4. Some building materials, such as roofing felt and fiberboard, are also made during the pulping process.

(PowerPoint Slide #52)

5. Wood pulp is used to manufacture other non-paper products: rayon, cellophane, nitrocellulose, acetate plastics, photographic film, smokeless powder, tire cord, cellophane tape, telephone parts, plastic handles, toys and many other products.

(PowerPoint Slide #53)

C. **Veneer** is a thin sheet of wood, 6 mm or less in thickness, used to make containers, such as baskets and boxes, and furniture items.

(PowerPoint Slide #54)

1. **Plywood** is manufactured from three or more sheets of veneer glued together, with the grain of alternate sheets running at right angles for strength.
 - a. Plywood is used for paneling, sheathing, furniture, concrete forms, sporting equipment, and hundreds of other uses.

(PowerPoint Slide #55)

2. When veneer or plywood logs arrive at a plant, they are cut into lengths to fit the lathe or veneer-cutting equipment.
 - a. Logs are usually heated for several hours in vats of hot water or steam chests. This aids removal of bark and softens the wood for easier cutting.

(PowerPoint Slide #56)

- b. The logs are moved to the lathe or veneer-cutting machine with a mechanical hoist. A log is turned in the lathe to peel off a thin sheet of continuous rotary veneer, or it is sliced or sawed into sheet by veneer-cutting machines.

(PowerPoint Slide #57)

1. Rotary veneer moves down a conveyor to large knives or clippers, where it is cut into required sizes and defective portions are removed.

(PowerPoint Slide #58)

- c. Veneer sheets are seasoned in dryers, run through glue machines and assembled into sets, depending on the number of plies or sheets in the plywood. The sets are inserted into hot presses, where they are glued together.

(PowerPoint Slide #59)

1. From the presses, the sets are trimmed to size. In higher grades of plywood, the defects are patched. Finally, if required, the plywood is sanded on one or both sides.

(PowerPoint Slide #60 shows the grading of plywood)

(PowerPoint Slide #61)

3. Since the late 1970s, plywood has lost its market to Oriented Strand Board (OSB). OSB utilizes low-value wood material that is cheaper to produce than plywood veneers.

(PowerPoint Slide #62)

- a. **OSB** is made of wafers (somewhat rectangular wood chips) oriented in layers along the length of the panel. This construction gives the panels greater strength and greater dimensional stability.
 - b. OSB panels are used in the same applications for which plywood is used.

(PowerPoint Slide #63 shows pictures of the manufactured wood materials)

(PowerPoint Slide #64)

D. When poles and piling arrive at a treatment plant, they are run through a debarking and rossing machine to remove the bark and smooth the surface before treatment.

1. Some poles are hand-peeled in the woods, and some are debarked and rossed at central points before arriving at the treatment plant.

(PowerPoint Slide #65)

2. From the debarking and rossing machine, the poles are cut to length and stacked onto small railroad cars for loading into pressure-treating vats.

(PowerPoint Slide #66)

E. A few railroad cross-ties are still hewn or cut in the woods. However, most ties are sawn in small portable sawmills and are made from low-quality hardwood logs.

(PowerPoint Slide #67)

F. Bark and wood residue, formerly waste materials, have become products in short supply. High value uses for bark are for decorative purposes and as soil mulches.

1. Because of the rising cost of energy, bark and wood residue are being used as fuel in many mill operations.

(PowerPoint Slide #68)

G. Many other products are made from wood, but they generally represent only a small fraction of the total timber harvested.

(PowerPoint Slide #69)

1. Fuelwood is one of the most important products. The demand for ***fuelwood*** (wood used for home heating) is increasing in response to rapidly rising cost of fossil fuels.
2. The demand for ***cooperage***, the material used to make wooden barrels, continues to decline as other packaging materials supplant barrels and kegs.

(PowerPoint Slide #70)

3. Pallets, constructed from lumber and plywood, have greatly mechanized product shipments made by truck, rail, water, or air.
4. Furniture and fixtures are other wood products utilizing both hardwoods and softwoods.

(PowerPoint Slide #71)

5. Treated posts are increasingly used not only for fences on farms and ranches but also for residential fences and for landscaping.

****Use TM: D3-5 thru D3-7 as material for lecture and discussion. These wood processing steps are general steps that are done around the world. If possible take students to a wood processing area in Afghanistan. This will allow them to see processing steps that are relative to your area. Talk about what Afghanistan's biggest wood needs are.**

Review/Summary: Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. The objectives on PowerPoint Slide #72 can also be used as review.

Application: Students will be able to explain the processing steps that are relative to Afghanistan.

Evaluation: Use the following sample test to evaluate the students' comprehension of the material covered in this lesson.

Answers to Sample Test:

Part One: Matching

1. e,
2. h,
3. g
4. f
5. d
6. l
7. a
8. b
9. j
10. c

Part Two: Completion

1. tree species, final product
2. bucking
3. green chain
4. veneer
5. cellulose
6. harvesting or logging

Part Three: Short Answer

1. cutting the trees, removing the limbs, cutting the trees into lengths, and either skidding the logs to a central point for loading or loading pulpwood bolts at the general cutting area
2. OSB utilizes low-value wood material that is cheaper to produce than plywood veneers.
3.
 - a. The location of cutting boundaries of the stand to be cut.
 - b. The marking of the timber to be harvested (except when all the timber is to be cut).
 - c. The cruise of timber to be removed.
 - d. The location of the most efficient log-loading sites.
 - e. The location of skid trails and haul roads.
 - f. The description of equipment to be used and the type of logging to be done; such as, short logs, long logs, or tree lengths.
 - g. The location of emergency equipment storage points, including firefighting tools, first-aid containers, and other emergency equipment.
4.
 - a. At very high rates of speed, electronic sorters automatically stack the lumber by size.
 - b. Closed-circuit TV allows machine operators to control equipment that is hundreds of feet away.
 - c. X-ray machines and computers scan logs and instantly decide the most profitable way for headsaws to cut them.
 - d. Computerized headsaws boost rough lumber recovery to 60 percent.
 - e. Thin saw blades reduce sawdust volumes by 5 percent.
 - f. Laser beams and water-jet headrigs may eliminate most sawdust and the need for some lumber planning.
 - g. Electro-mechanical machines can measure the stiffness and strength characteristics of individual pieces of lumber.

Test

Unit D Lesson 3: Processing Forest Products

Part One: Matching

Instructions. Match the term with the correct response. Write the letter of the term by the definition.

- | | | |
|---------------|----------------|-------------|
| a. bull chain | e. jack ladder | h. OSB |
| b. cants | f. Kraft | i. Plywood |
| c. coopeage | g. Limbing | j. Skidding |
| d. Felling | | |

- _____ 1. A version of the bull chain and it can look like a ladder.
- _____ 2. Made of wafers, rectangular wood chips, oriented in layers along the length of the panel.
- _____ 3. Cutting branches off either felled or standing trees.
- _____ 4. Paper made into brown paper grocery bags, cardboard boxes and similar products.
- _____ 5. Act of cutting or severing a tree from its stump.
- _____ 6. Manufactured from three or more sheet of veneer glued together, with the grain of alternate sheets running at right angles for strength.
- _____ 7. Chain device used to pull logs up into the saw mill.
- _____ 8. Squared-off log made by cutting off the rounded portion of the log.
- _____ 9. Part of the logging operation in which the logs are dragged from where they were cut to length to a central location for loading onto trucks or railroad cars.
- _____ 10. Material used to make wooden barrels and kegs.

Part Two: Completion

Instructions. Provide the word or words to complete the following statements.

- 1. The length of the log is dependent on the _____ and the desired _____.
- 2. _____ or cutting to length is cutting the felled trees into log or bolt lengths.
- 3. A system of moving rollers that carry the freshly cut lumber from the saws is called _____.
- 4. A thin sheet of wood, ¼ inch or less in thickness, used to make containers, such as baskets and boxes, and furniture items is called _____.
- 5. To make paper, the _____ must be chemically separated from the lignin binder by cooking the wood in sulfite, soda or sulfate solutions.
- 6. The key to forestry is _____ or _____.

TM: D3-1

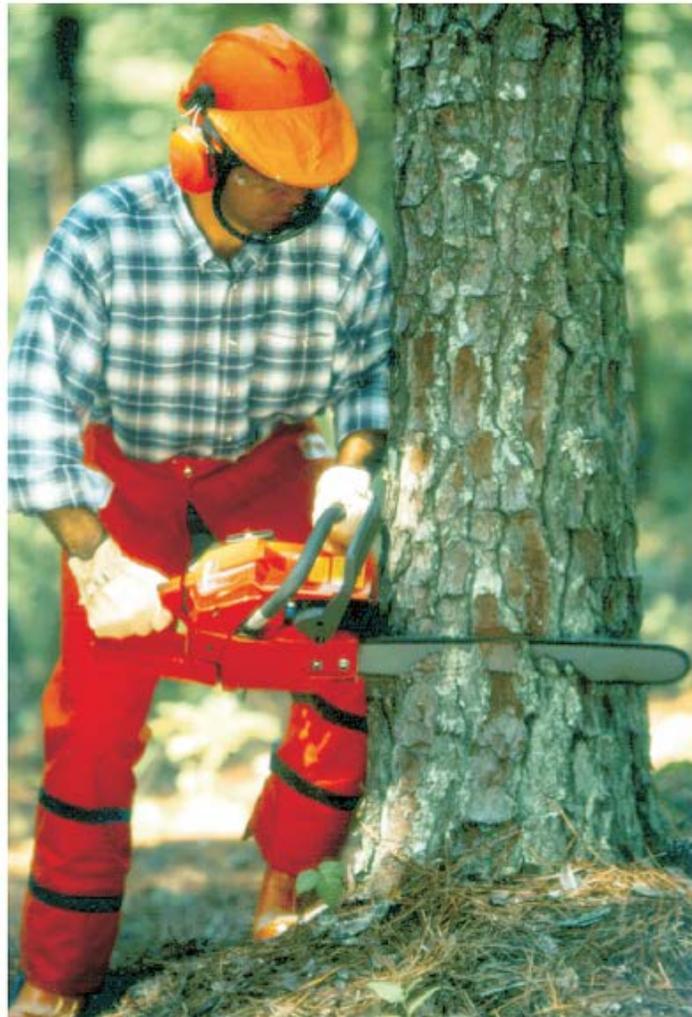
TREE FELLER



TM: D3-2

LOGGING SAFETY

Safety equipment is very important in any logging job.



TM: D3-3

LOG LOADING



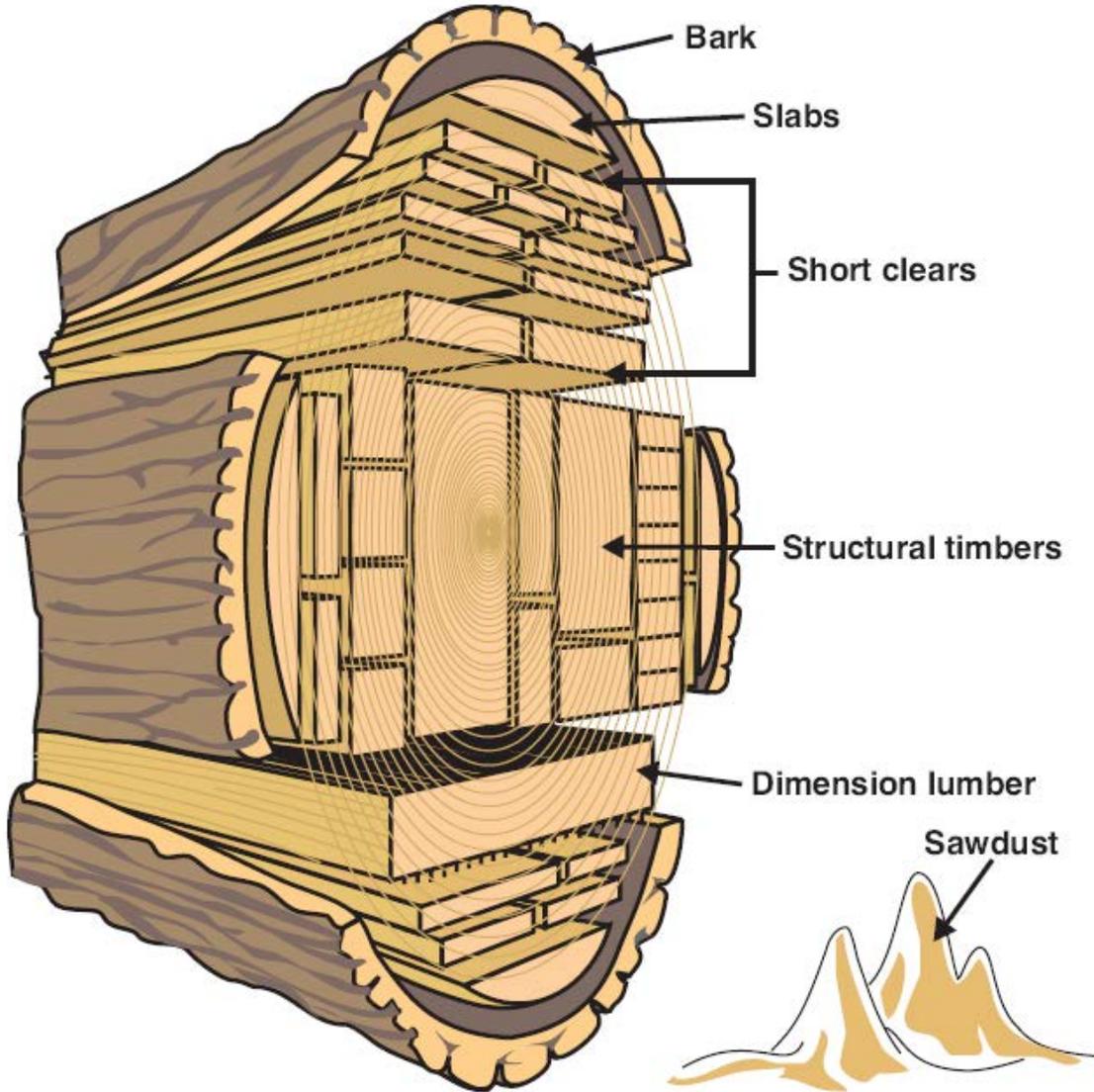
TM: D3-4

Pulpwood



TM: D3-5

SAWLOG PRODUCTS



TM: D3-6

MANUFACTURED WOOD MATERIALS



Veneer



Five Ply Plywood



Wafer Board

TM: D3-7

GRADING OF PLYWOOD



Sanded B-grade



D-grade



Grade stamping