



CHAPTER 1 - LOG SCALING

Log scaling is a system of measuring the volume of usable wood in a log before it is cut into lumber or other products. Log scaling is important to timber owners, foresters, loggers, and sawmills. This is because log volume measurements are used to help determine harvested timber values and products that can be made from it.

Throughout the United States, we use **board foot volume** to express log volume. The basic unit of measurement is one (1) board foot which is equal to a 12-inch by 12-inch board that is one (1) inch thick.

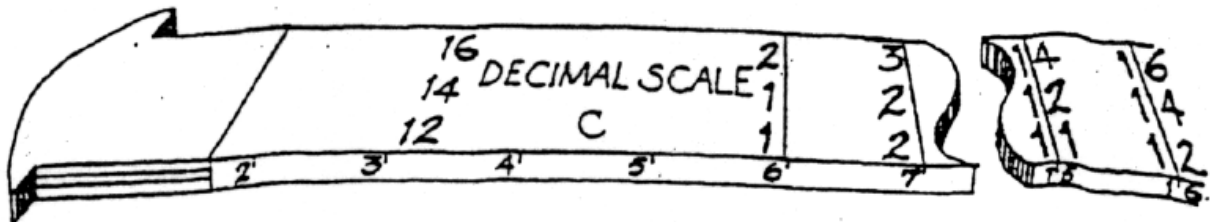
You need two measurements to determine the **gross board foot volume** of a log: **length** and **diameter**. Measure the length of a log in feet, and measure the diameter of the small end of the log in inches. You also need to determine the species of the log. You will learn about that later in this chapter.

LOG SCALING TOOLS

To determine the board foot volume of a log, you will need a **measuring tape** and either a **log scale stick** or a **log rule table**.

A log scale stick simplifies scaling because it combines both a measuring stick and a table of log volumes. Divisions on the log scale stick are to the one-half inch, so no rounding is needed.

There are different configurations of scale sticks available, and log lengths may be displayed differently, so be sure to be familiar with your tools. In the Forestry Contest, you will be using a Coconino Scribner Decimal C scale stick.

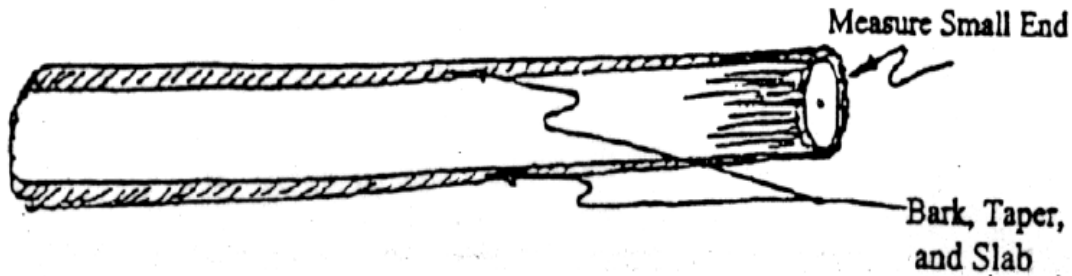


You can use any kind of measuring tape to measure log length. Professional scalers typically use logger's tape, which is a more rugged and versatile measuring tape.

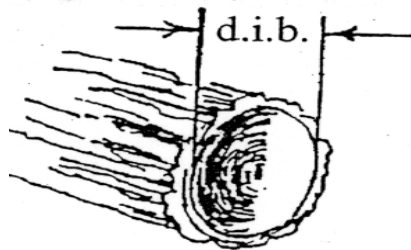
HOW TO DETERMINE BOARD FOOT VOLUME OF A LOG

Step 1: Measure The Diameter

Always measure the *diameter of the small end of the log*. Read the scale stick directly from the end of the log, not obliquely from the side.



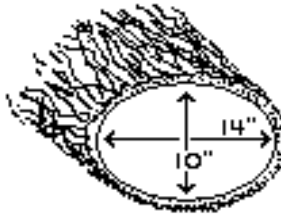
The diameter of a log is always measured inside the bark. This measurement is called "**diameter inside of bark**" or **d.i.b.** The bark is not considered in board foot volume because it is not usable wood. Use a log scale stick to measure the d.i.b. at the small end of the log.



Non-circular logs and rounding rules:

The ends of logs are not always circular, so you will determine the diameter by averaging the short measurement and long measurement, taken at 90 degrees from each other. Take both measurements through the true (geometric) center of the log, not the "center" of the log as shown by growth rings or pith.

$$\frac{10+14}{2} = 12$$



Take each diameter measurement to the nearest inch. Measurements that fall exactly on the 1/2-inch are rounded as follows:

- Round up when only one of the diameter measurements falls on the 1/2-inch.
- When both measurements fall on the 1/2-inch, round one up and the other down.
- When the average of the two diameters results in a 1/2-inch measurement, round down for the final scaling diameter.

Step 2: Measure the Length

Scaling length is always expressed in whole, one-foot increments. Measure the length of a log in feet and inches, and then round to the whole-foot increment by following these specific rules:

- Eight (8) inches or less: Round down to the next whole-foot increment.
- More than eight (8) inches: Round up to the next whole-foot increment.

Logs are usually cut a few inches longer than the scaling length specified by the sawmill to allow for minor log end damage and to square the ends of boards sawn from the log. In other words, a 16-foot log will generally be somewhat more than 16 feet long. This extra length is called **trim allowance**. Trim allowance will vary according to sawmill specifications. *Full trim allowance* is six inches, but logs often vary from this trim by up to two inches.

A log may have a *maximum of eight (8) inches of trim allowance* added to its scaling length. For example, a log measuring 16 feet 8 inches is considered to have a 16-foot scaling length when calculating volume. When a measured log length is more than 16 feet 8 inches, the scaling length is rounded up to the next higher foot, so a log that is 16 feet 9 inches in measured length has a 17-foot scaling length and the volume is calculated using that 17-foot length.

Below is a Scaling Length Determination Table used to calculate volume for all commercial log lengths up to 20 feet 8 inches. Based on this table, what scaling length would you use to calculate the volume of a log measuring 20 feet 10 inches?*

Measured Log Length	Scaling Length
8'1" – 8'8"	8
8'9" – 9'8"	9
9'9" – 10'8"	10
10'9" – 11'8"	11
11'9" – 12'8"	12
12'9" – 13'8"	13
13'9" – 14'8"	14
14'9" – 15'8"	15
15'9" – 16'8"	16
16'9" – 17'8"	17
17'9" – 18'8"	18
18'9" – 19'8"	19
19'9" – 20'8"	20

*Answer: 21 feet

Step 3: Calculate Board Foot Volume

After measuring the small end of the log's d.i.b. and log length, the **Scribner Decimal C Log Rule Table** is used to calculate its board foot volume. A portion of the Scribner Decimal C Log Rule Table used by professional Idaho scalers is on the next page. You will use this table or a **Coconino Scribner Decimal C scale stick** in the Forestry Contest to calculate board foot volumes of the logs you measure.

The Scribner Decimal C Log Rule Table is based on the "C" or third revision of an early 20th century log volume table that expresses board foot volumes in "decimal" form (the scale stick also does this). This means the actual volume figure has been rounded to the nearest 10 board feet (6 BF rounds up, 5 BF rounds down), the decimal point was moved to the left, and the zero was dropped.

For example, a log that scales at 802 BF was rounded down to 800 BF, the decimal was moved one place to the left (i.e. 80.0) and the zero was dropped, so the volume **reads** as 80 on the Scribner Decimal C Table or scale stick.

After determining the board foot volume on either tool, you must remember to multiply by ten (add the zero back) to express the **gross board foot volume** of the log (800 BF).

EXAMPLE A

To determine the board foot volume of a log using the Scribner Decimal C Log Rule Table, move your finger across the row from the d.i.b. (8 inches, for example) and down the column from the log length (18 feet, for example) to the point where they intersect (at 3).

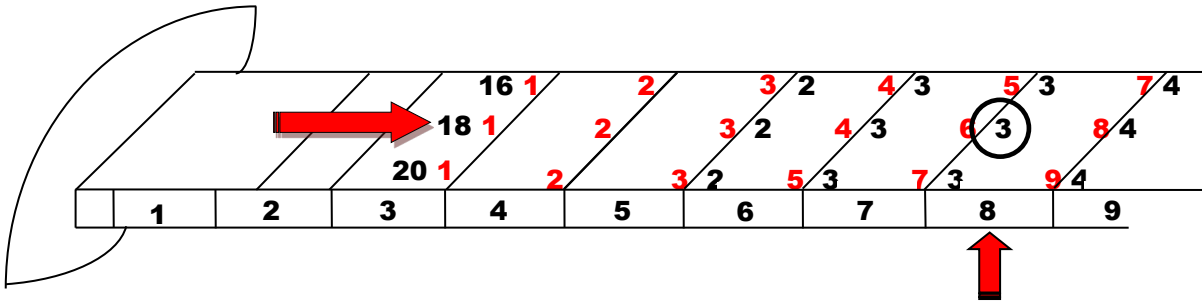
Remember, the words "Decimal C" mean that all board foot volumes shown in the table or on the scaling stick must be multiplied by ten (10). The simplest way to calculate board foot volumes using the Scribner Decimal C Log Rule Table is to add a zero (0) to all of the board foot volumes given in the table.

Therefore, a log measuring 8 inches d.i.b. and 18 feet in scaling length has a volume of 30 board feet (i.e., 8" d.i.b. x 18' length = 30 board feet).

LOG RULE TABLE

Diameter (inches)	IDAHO SCRIBNER DECIMAL "C" LOG RULE TABLE																
	Log Length (feet)																
	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
3										1	1	1	1	1	1	1	1
4					1	1	1	1	1	1	1	1	1	1	1	1	1
5		1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2
6		1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2
7	1	1	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3
8	1	1	1	1	1	1	2	2	2	2	2	2	3	3	3	3	3
9	1	1	1	2	2	2	3	3	3	3	3	3	4	4	4	4	4
10	1	1	2	2	3	3	3	3	3	4	4	5	6	6	6	6	7
11	1	2	2	2	3	3	4	4	4	5	5	6	7	7	8	8	8
12	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	10	10
13	2	3	4	4	5	5	6	7	7	8	8	9	10	10	11	12	12
14	3	4	4	5	6	6	7	8	9	9	10	11	11	12	13	14	14
15	4	4	5	6	7	8	9	10	11	12	12	13	14	15	16	17	18
16	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
17	5	6	7	8	9	10	12	13	14	15	16	17	18	20	21	22	23
18	5	7	8	9	11	12	13	15	16	17	19	20	21	23	24	26	27
19	6	8	9	10	12	13	15	16	18	19	21	22	24	25	27	28	30
20	7	9	11	12	14	16	17	19	21	23	24	26	28	30	31	33	35
21	8	10	12	13	15	17	19	21	23	25	27	28	30	32	34	36	38
22	8	10	13	15	17	19	21	23	25	27	29	31	33	35	38	40	42
23	9	12	14	16	19	21	23	26	28	31	33	35	38	40	42	44	47
24	10	13	15	18	21	23	25	28	30	33	35	38	40	43	45	48	50
25	11	14	17	20	23	26	29	31	34	37	40	43	46	49	52	54	57
26	12	16	19	22	25	28	31	34	37	41	44	47	50	53	56	59	62
27	14	17	21	24	27	31	34	38	41	44	48	51	55	58	62	65	68
28	15	18	22	25	29	33	36	40	44	47	51	54	58	62	65	69	73
29	15	19	23	27	31	35	38	42	46	49	53	57	61	65	68	72	76
30	16	21	25	29	33	37	41	45	49	53	57	62	66	70	74	78	82

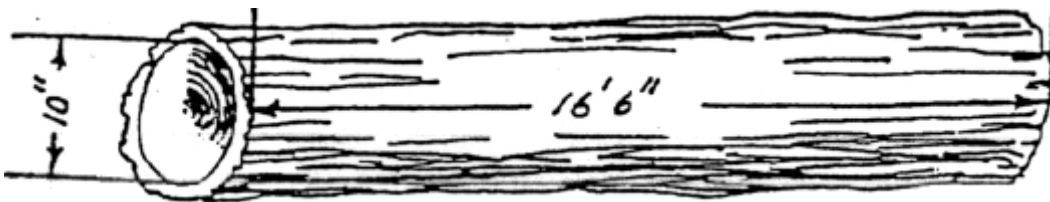
To find log volume using a scale stick, measure the d.i.b. by laying the stick across the small end of the log with the tip of the metal end at the inside edge of the bark. Read the diameter on the narrow sides of the stick. This inch-scale is designed to automatically round your d.i.b. measurement to the nearest inch. After measuring log length, find that measurement on the wide side of the stick, near the end plate (one side is for 10, 12, and 14-foot logs and the other is for 16, 18, and 20-foot logs). In the diagram below, the red arrows show how to read the volume of an 18-foot log with an 8-inch d.i.b. The volume (3) is circled. Remember to multiply it by 10 to determine the actual gross board foot volume.



Note: Ignore the red numbers on the scale stick for the purpose of the Forestry Contest because those are used for calculating defect and net volume, which is beyond the scope of the contest.

EXAMPLE B

Suppose that you measure the d.i.b. of a log at the small end, and it is 10 inches. The log measures 16'6" in length. What is the board foot volume of the log?



Here is the procedure to follow, using the log rule table:

Starting at the top, look down the d.i.b. column until you find the proper diameter inside of bark (d.i.b.). In this example, it is 10 inches.

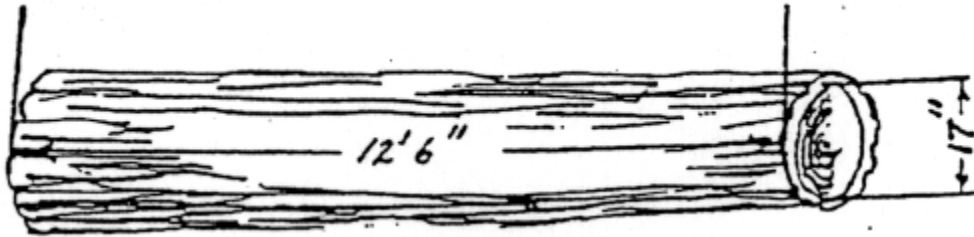
Next, move your finger across the top row of numbers until you find the proper log scaling length. In this example, it is 16 feet (with standard trim allowance).

Now, go across the row corresponding to d.i.b. 10" and down from the 16' length to the intersection of the row and column. In this case, the answer is 6.

Add a zero to that answer to get the correct log volume of **60** board feet.

EXAMPLE C

In this example, the d.i.b. measurement is 17 inches and the measured length is 12 feet 6 inches (12'6"). What is the board foot volume of this log?



Remember, although the measured length is 12 feet plus the full trim allowance of 6 inches, the log is 12 feet in scaling length.

The correct answer from the table is 17 d.i.b. x 12 ft. → 14 Decimal C volume, so it must be multiplied by 10 to give the gross board foot volume. Therefore, the correct log volume is **140** board feet.

LOG DEFECT

The procedure described above for determining the gross board foot volume assumes that the log is completely straight and the entire log can be used to manufacture lumber. In reality, logs are sometimes crooked or contain decay that makes a portion of the log unusable for lumber. This unusable portion is called defect, and it is deducted from the gross board foot volume to determine the net board foot volume in a log.

The amount of defect measured and deducted is a somewhat subjective measurement based on a scaler's forestry training, knowledge, and experience. It is not within the scope of the Forestry Contest to be able to accurately measure defect. Therefore, students only need to be concerned about learning to measure the gross volume of logs with no defect.

DETERMINING LOG SPECIES

You must also be able to identify the species of logs. Scalers must identify species because log volumes and wood characteristics, which determine value, vary widely by species.

Log volumes differ for tree species because of variations in the amount of **taper**, i.e. the conical shape of the trunk (diameter or width at the bottom versus the small diameter at the top). White pine trees, for example, tend to be tall without much tapering of the trunk diameter towards the top in comparison to the bottom (Figure 1). By contrast, western redcedar trees tend to be wide at the bottom and fairly short, tapering quickly to the top (Figure 2). The amount of taper in a log affects the volume of lumber that can be sawn from it.



Figure 1. White pine trunk shape



Figure 2. Cedar trunk shape

Wood characteristics are very important because they determine the products that can be manufactured and, therefore, the value of the wood. Log values vary tremendously depending on species.

The following attached **Appendix A-1** from the Idaho Board of Scaling Practices Manual provides excellent guidance for learning how to identify logs of the following **nine Idaho commercial species**:

- western redcedar
- Douglas-fir
- western hemlock
- western larch
- lodgepole pine
- ponderosa pine
- western white pine
- Engelmann spruce
- grand fir

APPENDIX A-1 – SPECIES IDENTIFICATION

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A-1.1 GENERAL

The ability to identify logs by species is extremely important to the scaler because of the wide differences in value of the various species; for example, a Cedar log may be worth significantly more than a Grand fir log of equal volume. Consequently, errors in species identification by a scaler may result in considerable financial loss to the buyer or the seller. Through study and properly supervised experience, however, the scaler should develop the skills required for accurate species identification in a short time.

The problem of species identification in Idaho is somewhat involved because of the number of commercial species that occur in the state. In any given area or operation the number of species that the scaler must identify may be half a dozen or more. Most of the commercial species in Idaho are conifers, with the following eleven considered to be those of major importance:

C	Cedar.....	<i>Thuja plicata</i>
DF	Douglas Fir.....	<i>Pseudotsuga menziesii</i>
H	Western Hemlock.....	<i>Tsuga heterophylla</i>
L	Larch.....	<i>Larix occidentalis</i>
LP	Lodgepole Pine.....	<i>Pinus contorta</i>
PP	Ponderosa Pine.....	<i>Pinus ponderosa</i>
WP	White Pine.....	<i>Pinus monticola</i>
S	Engelmann Spruce.....	<i>Picea engelmanni</i>
AF	Alpine Fir.....	<i>Abies lasiocarpa</i>
GF	Grand Fir & White Fir.....	<i>Abies grandis</i> & <i>Abies concolor</i>

It is generally not necessary for a scaler to distinguish between Grand fir and White fir, but occasionally a scaler may be required to separately identify Western Hemlock and Mountain Hemlock. Conifers of lesser commercial importance because of their scrubby growth characteristic, inaccessibility, or widely scattered distribution include:

MH	Mountain Hemlock.....	<i>Tsuga mertensiana</i>
WB	Whitebark Pine & Limber Pine....	<i>Pinus albicaulis</i> & <i>Pinus flexilis</i>

Hardwoods are usually of little importance as timber trees in Idaho. Black cottonwood and Quaking aspen have occasionally been commercially harvested.

CW	Black Cottonwood.....	<i>Populus trichocarpa</i>
QA	Quaking Aspen.....	<i>Populus tremuloides</i>

Rarely, some other tree or shrub species not previously mentioned may be presented for scaling. They may be classified as “Other” using species abbreviation “O”.

Generally speaking, a scaler depends largely on bark characteristics, and color and amounts of sapwood and heartwood for identification purposes. Scalers must also be able to accurately identify species of dead or barked logs. Especially in the spring and early summer, bark can slough off easily during the logging process. Under these

conditions a scaler depends largely on things such as color and amounts of sapwood and heartwood, presence of pitch, and the size, color, and distribution of knots as the basis for identification.

In using bark characteristics for identification of logs, a scaler must keep in mind that in many species, the bark on young trees may be very different in color and texture from the bark on older or mature trees. Logs cut from the lower boles of older trees may also have different bark characteristics than those cut from the upper boles. These differences are pointed out in the descriptions given in this chapter.

The descriptions of species that follow are designed to give the features of greatest value in scaling practice. An effort has been made to list all printable common names in use in Idaho for each species.

A-1.2 MAJOR COMMERCIAL SPECIES

A-1.21 Cedar



Species. (*Thuja plicata*) Common name is Cedar, also called red cedar or western red cedar.

Bark. The bark, light reddish-brown on young trees and grayish-brown on old trunks, is thin (1 to 3 inches thick), and forms a network of long, thin, fibrous strips. The stringy shreds of bark adhering to logs are one of the most identifiable characteristics.

Sapwood. The sapwood is thin, nearly white, and non-resinous.

Heartwood. The heartwood is soft and brittle, reddish-brown to pinkish-brown, and has a pungent, distinctive odor. The contrast between heartwood and sapwood is pronounced.

Knots. Knots are generally scattered around the tree with a dark brown center surrounded by lighter brown or tan colored wood.

Foliage. The leaves of Cedar, borne in flattened groups of four, are very small and scale-like. The branch-lets have a "fern-like" appearance and are dark, glossy green on the upper surface.

A-1.22 Douglas Fir



Species. (*Pseudotsuga menziesii* variety *glauca*) Common name is Douglas Fir, also called red fir or simply “Doug” fir.

Bark. On young trees the bark is smooth, gray-brown, and broken by pitch blisters. On mature trees it gradually becomes corky and deeply furrowed. Mature bark, dark red-brown to a very light gray, usually shows a lighter, almost orange color deep in the furrows. The mature bark is 2 to 6 inches thick. Second growth bark is usually 1/2 inch to 2 inches thick.

Sapwood. The sapwood is a pale yellow or off white to a reddish-cream color, rather narrow, and pitchy.

Heartwood. The heartwood is hard and yellowish-brown to deep reddish-brown in color. The contrast between heartwood and sapwood is usually very distinct.

Knots. Douglas fir knots are usually reddish brown in the center surrounded by a darker brown wood and will generally be pitchy.

Foliage. Douglas fir needles -- medium green to blue-green in color, 3/4 inch to 1 inch long, flexible, and with rounded ends are borne singly and are arranged all around the twig. The most notable feature of foliage is the pointed, red-brown buds.

A-1.23 Hemlock



Species. (*Tsuga heterophylla*) Common name is Hemlock, also called western hemlock. Similar in appearance to mountain hemlock, it is usually not necessary to separately identify “western” and “mountain” hemlock when scaling in Idaho.

Bark. On young trees the bark is dark reddish-brown to purple-brown and is broken into small, rounded scales; on mature trees, the bark has deep furrows between flat ridges, which are covered with close-set, dark brown to purple-gray scales. The underbark on Hemlock of all ages is a bright red streaked with purple when cut lengthwise. Inner-bark on Hemlock is a dark cocoa-brown compared to a lighter brown inner-bark on grand fir.

Close-up showing difference of inner-bark between Hemlock and Grand fir

Hemlock (left) and Grand fir (right)



Sapwood. The sapwood is quite thin. The last few outer rings, sometimes almost white, are the only portion of the sapwood, which may show any contrast to the heartwood. A slightly dented or wavy surface is common in areas where the bark is missing on the outside of the log.

Heartwood. The heartwood is hard, tough, and closely-grained, usually pale tan or cream colored; but occasionally it may have a reddish or purplish cast, especially in the summerwood portion of the annual rings. Usually there is little or no contrast between heartwood and sapwood. The absence of resin and lack of contrast between the cream colored heartwood and sapwood are typical of both western and mountain hemlocks.

Knots. The larger knots are hard, dark cream colored and may be surrounded by a black ring on the outside edge. Smaller knots are usually black and may show a black stain in the bark.

Foliage. The needles are small and flat, 1/4 inch to 1 inch long, and irregular in length. They are dark green on top and pale green with two white bands beneath.

A-1.24 Larch



Species. (*Larix occidentalis*) Common name is Larch, also called western larch or tamarack.

Bark. On young trees the bark is scaly and reddish-brown to purplish-brown. On older trees, it is deeply furrowed and broken into irregularly shaped plates, usually purple-gray in color, but sometimes brown to reddish-brown. Bark is relatively thick at all ages, being 4 to 6 inches thick on mature butt trunks. Larch bark, which may be confused with that of Ponderosa pine, has a reddish-purple color under the scales in contrast to the yellow patches under the scales of Ponderosa pine.

Sapwood. The sapwood is thin (1/4 inch to 1 inch thick), nearly white to light pale brown, and may be slightly pitchy. One of the most distinguishable features is the sharp color contrast between the narrow band of sapwood and the heartwood.

Heartwood. The heartwood is hard, reddish-brown to dull brown in color. The contrast between heartwood and sapwood is distinct. At times the log end may resemble a “target” with distinct bands of light and dark colored rings.

Knots. Knots are scattered, light reddish-brown in the center, surrounded by light tan or pale brown wood. Larch knots have a tendency to be clustered with several knots forming small bunions or bulges on the side of the log.

Foliage. Needles are borne in dense clusters on small raised bumps on the twigs. They are 1 to 1 1/2 inches long, thin, flexible, and light green in color. In the fall they turn bright yellow and then drop off. This is the only conifer in Idaho that loses its needles.

A-1.25 Lodgepole Pine



Species. (*Pinus contorta*) Common name is Lodgepole Pine, also called jack pine, black pine, or simply “lodgepole”.

Bark. The bark on young trees is dark gray to almost black and very scaly. Bark on mature Lodgepole pine differs in northern and southern parts of the state. In northern Idaho the mature bark is made up of narrow ridges, broken into almost square or rectangular plates with the ridges separated by deep furrows. The overall color is almost black to dark gray. Cutting length-wise into the bark reveals numerous, small white specks of pitch. In the southern part of Idaho mature Lodgepole pine bark is light brown or orange-brown to almost gray and is covered by thin, loose scales. Knocked-off scales reveal a greenish color where the scales were attached.

Sapwood. The sapwood is narrow, nearly white to pale yellow in color. Often there is no easily discernible difference between heartwood and sapwood, though the sapwood is usually somewhat lighter in color. Pitch exudation is conspicuous on the sapwood.

Heartwood. The heartwood is light yellowish white to pale yellow and may have a slight pink hue.

Knots. These are scattered and often have a dimpled appearance with small catfaces surrounding them.

Foliage. The yellow-green to light green needles are borne in bundles of two and are 1 to 3 1/2 inches long.

A-1.26 Ponderosa Pine



Species. (*Pinus ponderosa*) Common name is Ponderosa Pine, also called “P” pine, bull pine, yellow pine, and western yellow pine.

Bark. The bark on young trees (80 to 100 years old) is broken into ridges covered with small, thin platelets, dark reddish-brown to nearly black, and from 1/2 inch to 1 1/2 inches thick. Young trees with this dark bark are often called bull pine. On older trees the bark is often from 2 to 4 inches thick, divided into deep and irregular plates, sometimes 4 to 5 feet long and 12 to 18 inches wide. These larger plates are covered with thick, yellow-brown to orange-brown irregular platelets.

Sapwood. Young Ponderosa pine is 80 to 100 percent sapwood. In older growth, the sapwood is usually 2 to 12 inches thick. This sapwood is cream-colored, and pitch exudation on the sapwood is usually conspicuous.

Heartwood. The heartwood is yellowish to light reddish-brown and usually has a conspicuous brown center or pith. There is a definite pitchy odor.

Knots. Are scattered, bulging, and can be quite large. The knots are usually reddish-brown to a dark brown in color surrounded by cream colored wood. The center of the knot is often hard and brittle.

Foliage. The needles of Ponderosa pine are usually borne in bundles of three (sometimes two to five), 5 to 11 inches long, and dark green in color.

A-1.27 White Pine



Species. (*Pinus monticola*) Common name is White Pine, also called Idaho white pine or western white pine.

Bark. The bark on young trees is usually smooth and light gray-green in color. On old trees it is 3/4 inch to 1 1/2 inches thick, and is divided into small, nearly square plates by deep lengthwise and crosswise fissures covered by small, thin or closely oppressed purplish-gray scales.

Sapwood. The sapwood is whitish to a light cream in color, soft, and from 1/2 inch to 3 inches thick. A conspicuous exudation of pitch (resin) is generally visible in the sapwood on the log ends. In older decked logs the sapwood may be almost white in color.

Heartwood. The heartwood is usually an off white but may have a pale pink to light reddish-brown hue. The wood is soft, straight-grained, and has a slightly pitchy or resinous odor.

Knots. Knots are usually whorled around the tree in a single row with large areas in between the whorls containing no knots. The centers of the knots are pink in color; this is especially visible in the smaller knots.

Foliage. Needles are borne in bundles of five, 2 to 4 inches long, and blue-green in color.

A-1.28 Spruce



Species. (*Picea engelmanni*) Common name is Spruce, also called Engelmann spruce.

Bark. The bark is from 1/4 to 1/2-inch thick, usually light purplish-gray to orange-brown in color, and broken into larger, thin, loose scales.

Sapwood. The sapwood is 2 to 4 inches thick, pale yellow to pale yellow-brown in color, and may be slightly pitchy.

Heartwood. The heartwood is usually about the same color as the sapwood, sometimes slightly darker. As a rule, it is extremely difficult to differentiate between heartwood and sapwood.

Knots. Knots are generally scattered around the log and are about the same color as the heartwood on Spruce logs.

Foliage. The blue-green needles are borne singly and are usually about 1 inch long. They are moderately stiff and sharp-pointed; crushed needles have a pungent odor.

A-1.29 Grand Fir



Species. (*Abies grandis*) Common name is Grand Fir, also called white fir (the common name "white fir" is also used for *Abies concolor* whose native range in Idaho is the southeast corner of the state; for commercial scaling in Idaho, species identification as "grand fir" or "white fir" is used interchangeably for either species).

Bark. Young trees have smooth, gray-green bark with numerous pitch blisters. Older trees begin to develop a furrowed, rough bark, which is up to 2 inches thick and is dark gray-brown to purple-gray in color on mature trees. In southern Idaho trees, the bark is corky in texture and resembles Douglas fir bark.

Sapwood. The narrow sapwood, light cream to pale yellowish-brown, is not resinous; although some pitch from the inner bark may be present on the sapwood. It may be difficult to distinguish the sapwood from the heartwood.

Heartwood. The soft heartwood of Grand fir is not distinctively different in color from the sapwood, although it may be slightly darker. The summerwood portion of the annual rings may be faintly pinkish in color.

Knots. The absence of resin exudation from the sapwood on ends of logs and the similarity in color of sapwood and heartwood are marked features. A dark water core is sometimes present and growth rings are conspicuous.

Foliage. Grand fir needles are borne singly and those of the lower crown are arranged in flat rows along each side of the twig. They are about 1 to 2 inches long and are dark glossy green on the upper side with whitish streaks on the underside. Crushed needles give off a pleasant aromatic odor.

A-1.4 SPECIES IDENTIFICATION CHART

Some general characteristics to aid in the process of species identification are shown in the chart below.

Log Species Identification Chart	Bark - scaly or plated (on mature trees)	Bark - deeply furrowed (on mature trees)	Bark - stringy & fibrous	Heartwood / Sapwood light-color, little contrast	Heartwood / Sapwood dark color, strong contrast	Knots – pinkish color	Knots – yellowish color	Pith - large & distinct	Pitchy sapwood	No pitch, sap or heartwood
Species										
White Pine	X			X		X			X	
Ponderosa Pine	X			X				X	X	
Lodgepole Pine	X			X					X	
Douglas Fir		X			X				X	
Larch	X				X				X	
Grand Fir		X		X						X
Hemlock		X		X						X
Spruce	X			X					X	
Cedar			X		X					