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# An Evaluation of the Grades and Value of Red Alder Lumber in Southeast Alaska

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## Abstract

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Many stands in southeast Alaska harvested since 1950, especially where there has been a high degree of disturbance of mineral soil, have regenerated to red alder (*Alnus rubra* Bong.) and are now approaching maturity. The availability of red alder raises questions addressed in this study about the recovery of lumber from this resource. Information in this study was obtained from trees estimated to be 46 years old on a site outside of Ketchikan. Rates of recovery using a thin-kerf portable band mill were higher than those reported by larger production mills in Washington and Oregon. Grade yields of the Alaska material are comparable to those attained in other regions. This study determined that there were no significant differences in material characteristics that would set this Alaska log resource apart from red alder in the other regions of North America. The potential value of the products is sufficient to allow production in Alaska for use in the manufacturing of value-added products within the state or shipment of finished lumber to domestic or export markets.

Keywords: Red alder, southeast Alaska, lumber, grade, value-added products.

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## Introduction

There has been a long-standing interest in the silvicultural and ecological characteristics of red alder (*Alnus rubra* Bong.). Information has been published relative to inventory volumes, log characteristics, and volumes of products produced. The information in the following paragraphs has been summarized from reports published in 1926 (Johnson et al.), 1962 (Worthington et al.), and 1984 (Harrington). Other reports contain information and citations similar to the noted reports. Although these three reports and many others include maps that show the range of the species as including most of southeast Alaska, there is little information that specifically reports on the properties of red alder from Alaska.

Red alder is the most common hardwood growing in the Pacific Northwest. Although it previously existed in the old-growth forests of the region, the species is relatively short lived and shade intolerant. Pure stands of the species are usually found in areas with abundant soil moisture, but not subject to water overflows of any long duration. The species rapidly invades openings caused by natural disturbances, prescribed fire, and harvesting to create both pure and mixed-species stands. The softwood component of the mixed stands in southeast Alaska include western hemlock (*Tsuga heterophylla* (Raf.) Sarg.), western redcedar (*Thuja plicata* Donn ex D. Donn), and Sitka spruce (*Picea sitchensis* (Bong.) Carr.). Trees become mature at 60 to 70 years of age and attain a maximum age of 100 years.

Before the middle of the 20<sup>th</sup> century, the species was considered a weed tree primarily used for firewood, pulpwood, and specialty products. In the second half of the century, a combination of increasing availability and demand for hardwood lumber stimulated the growth of a hardwood lumber industry in the Pacific Northwest. The primary reason for increasing volume is attributed to the fact that the species is a prolific and consistent seed producer and consequently, rapidly establishes in harvested areas, especially in areas with a high degree of soil disturbance.

Shortly after World War II, long-term cutting contracts were issued to supply raw material to pulp and sawmills in Sitka and Ketchikan. Four hundred and fifty thousand (450,000) acres (Nowacki et al. 2001) of forest were harvested using clearcutting systems. The harvested areas are geographically centered on Sitka and Ketchikan, the locations of the pulp mills holding the timber supply contracts. The primary area converted to alder stands was adjacent to roads and landings where there was soil disturbance. In 2001, increasing levels of alder ingrowth were reported by the U.S. Department of Agriculture, Forest Service (USDA Forest Service) Alaska Forest Inventory and Analysis group (Van Hees 2001a, 2001b).

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Since 2000, Region 10 (Alaska Region) of the USDA Forest Service has annually collected production information from the major active mills in southeast Alaska (Brackley et al. 2006, Kilborn et al. 2004). The information has been collected by surveying mill owners. Species processed is an item included in the survey. Red alder was included in a category defined as “other.” Less than half of 1 percent (0.5 percent) of the total mill production has been reported as “other.” In addition to red alder, “other” species may include true firs and shore pine (*Pinus contorta* Dougl. ex Loud. var. *contorta*) (a variety of lodgepole pine (*Pinus contorta*)).

Based on the Alaska Wood Products Manufacturers Directory (Parrent 2004), which lists most of the known sawmills and secondary forest products manufacturers in the state, there are four mill owners in southeast Alaska who reported producing rough, green red alder lumber. Three of the mills are not in full-time operation. The remaining mill is in continuous operation and fully equipped to produce dried and planed material. The recently reported production of this mill is all softwood. None of these producers are listed as having the ability to produce a graded product.

Given increasing availability and a low level of use of red alder, this project was undertaken to obtain information relative to the recoverable volumes and grade yields of lumber from the red alder that is native to southeast Alaska. As the project developed, two distinct information needs were defined. First, it was noted that there is little published information relative to the mensurational characteristics of the Alaska material. Such information is required by land managers for conducting inventory projects, planning timber sales, and controlling forestry operations. Second, there is no information available on the volume, grade recovery, and product value from Alaska logs. This project is designed to provide preliminary information for forest managers and entrepreneurs interested in management objectives and markets for the red alder resource in southeast Alaska.

## Objectives

This study is part of an effort to compare the similarities and differences between red alder in southeast Alaska and other regions of the Pacific Northwest. The study is also designed to provide information that can be used for inventory, forest management, and appraisal purposes. Additional studies may be required to evaluate items that have an impact on harvesting, processing, and marketing the resulting product. The specific objectives of this project are as follows:

- Provide descriptive statistics to describe the mensurational characteristics of trees and logs included in this study.
- Compare volume and grade recovery using a portable thin-kerf band mill (equipment commonly used by small mills in southeast Alaska) with yields from other studies.
- Compare overrun percentage, cubic recovery ratio (CRR) and lumber recovery factor (LRF) from the Alaska material with reported values from other regions.
- Provide preliminary information for managing the resource.
- Provide information for mill owners and entrepreneurs interested in producing the product.

In conducting the study, it was determined that existing methods of harvesting, utilization, and scaling in southeast Alaska have evolved and are primarily designed for harvesting and processing large logs from old-growth material. The Scribner C log rule has traditionally been applied to long, large-diameter old-growth logs. The procedures for determining scaling diameter (NWLRA 2003, USDA FS 2004) always result in a value that is rounded down. In large logs, the rounding down causes an insignificant reduction in volume. In small logs, the rounding down can result in volume reduction of up to 20 percent or more for an individual log. When the cubic scaling method (USDA FS 1991) is applied, the procedure for determining scaling diameter is slightly different, but rounding down does produce significant underestimation of volume. In logs 6 to 10 inches in diameter, the underestimation of volume may be as great as 25 percent. The project plan and data collection methods were designed to address these problems by calculating stem and log volumes by using stem analysis measurements. Although we make reference to these issues and use the volumes from the stem analysis methods in this report, complete analysis of these measurement and scaling problems will be reported in a future publication.

## **Literature Review**

### **Mensurational Information**

The available information reporting growth and volume characteristics for red alder is based on material from stands in Oregon, Washington, and British Columbia. Volume tables have been developed based on Scribner and International log rules and cubic volume (Johnson et al. 1949). Site curves were developed for 43 red alder trees distributed throughout western Washington (Bishop and Johnson 1958).

Height growth and site index curves have also been developed for natural red alder stands between 5 and 50 years old in western Washington and northwestern Oregon (Harrington and Curtis 1985). Although most growth and yield models are based on 5- to 10-year intervals, preliminary work is underway to provide diameter and tree growth equations for red alder on an annualized basis (Weiskittel et al. 2006). Bole volumes and crown weights of five western hardwoods (including red alder) have been predicted through regression equations that were all based on diameter at breast height (d.b.h.) (Snell and Little 1983).

### Grading Rules and Lumber Tally

Compared with other regions of the United States, the Pacific Northwest processes only limited volumes of hardwood. The major product of sawmills in the Pacific Northwest is softwood dimension lumber produced in accordance with the American Lumber Standards (NIST 2005). Within the region, factory and shop grades of lumber are also produced from softwoods. The standards and terminology for production of factory and shop grades of lumber are different than those applied to the production of structural dimension lumber. Softwood factory and shop grades, however, are more closely related to the grading standards for hardwood lumber. One major difference between dimension lumber and factory, shop, and hardwood grades is the range of thicknesses that are produced. In the softwood dimension standards, most of the lumber is assigned a nominal thickness based on units of a full inch (1, 2, 3, etc.). In both the softwood and hardwood industries, thickness of the factory and shop are produced and tallied in increments of one-fourth inch for material 1 inch thick and larger (4/4, 5/4, 6/4, 7/4, 8/4, etc.). Analogous to the softwood dimension lumber grading system (WWPA 2005), these 1/4-inch units become the nominal dimension of the rough green product used to tally board foot volumes.

Rules for grading hardwood lumber have been developed by the National Hardwood Lumber Association (NHLA) (NHLA 2007). In general, the rules for appearance grading of softwood lumber (WWPA 2005) have much in common with the hardwood procedures in that the result of the grading process is a classification that defines the number of clear and sound cuttings that can be produced from the board of a given grade. This differs from the grading processes for softwood dimension lumber where defects are identified to reflect their impact on the strength of the piece.

Nominal widths of softwood dimension products are always in multiples of 2 inches, and lengths usually in multiples of 2 feet in pieces 6 feet or longer. In

contrast, hardwoods are produced in widths that are in multiples of 1 inch. In production, softwood dimension with a nominal thickness of 2 inches would result in a dried product that was 1 ½ inches thick. The target size for rough green material to allow production of a dry, surfaced thickness of 1 ½ inches (dimension lumber with a nominal thickness of 2 inches) would have to be sufficient to take shrinkage, planing, and sawing variation into account. In most modern mills, this would be a rough, green thickness of 1.6 to 1.7 inches (Brown 1982). When producing the hardwood with the same nominal thickness (8/4 inches), the thickness when surfaced and dry would be 1 ¾ inches (NHLA 2007). In the hardwood products at these sizes, there is 16.7 percent more wood in a board foot than in dimension products. The exact relationship between tallied board feet and solid cubic content of the final dried and planed product is a function of nominal width. When evaluating the recovery factors for various products, these relationships must be considered.

In the hardwood industry, many purchase and sale contracts make reference to NHLA (2007) grading rules, but also state allowable variations to the NHLA grades. The NHLA rules allow such variation and state this fact by use of the phrase, “unless otherwise specified.” In the event of a dispute between buyer and seller, inspection by an authorized inspector is required, and the terms (specifications) of a written contract are recognized in the inspection process. Given this fact, the commerce of hardwood lumber is referenced to the NHLA rules but may differ based on a written contract signed by buyer and seller.

## Measures of Sawmill Recovery and Efficiency

The following information was derived from *Forest Products Measurements and Conversion Factors* by David Briggs (1994). This document is a common source of information relative to conversion factors for the Pacific Northwest.

Estimates of standing timber volume and scaled volumes of harvested logs are reported in terms of board foot volumes that can be produced when the material is sawn. Overrun or underrun values report the difference between the predicted scale volume and the actual recovered volume of material tallied by the mill. The following formula is used to calculate overrun or underrun values:

$$\text{Overrun\%} = 100 \times [\text{BFmt} - \text{BFIt}] / \text{BFIt},$$

where:

BFmt = board feet mill tally

BFIt = board foot log scale

Given the number of log rules in the United States and Canada, this factor is of little value other than to report the ratio between the log rule used in a specific region and the tally of lumber actually produced by a mill.

Cubic recovery ratio (CRR) is defined in Briggs (1994) as the fraction of log volume recovered as lumber. This ratio may be used to calculate recovery of both rough green or surfaced dry volumes. Obviously, the difference between the volume of rough green lumber volume and original log volume is sawdust, plus chippable material in slabs and edgings. The difference between volume of rough green lumber and dry surfaced material are shrinkage in drying and planer shavings. The general formula for calculating CRR for rough green material and original log volume (usually net volume) is as follows:

$$\text{CRRgt} = \text{AFgt} / V,$$

where:

CRRgt = cubic recovery ratio for lumber at green target thickness

AFgt = true fiber content of lumber, green target basis, in cubic feet

V = net log volume in cubic feet

The LRF is reported by Briggs (1994) as the volume of mill-tallied recovered lumber in board feet divided by the cubic feet of log volume (usually net cubic scale). The formula for calculating LRF is as follows:

$$\text{LRF} = \text{BFmt} / V$$

Obviously, the calculation of CRR and LRF is sensitive to the methods used to calculate log volume. As mentioned previously, use of USDA Forest Service cubic scaling methods will result in underestimation of volume and may have an impact on the factors.

## Yield Studies

Numerous research studies have considered product recovery from softwood species, including work by the USDA Forest Service, Pacific Northwest Research Station. These studies have collectively considered a range of tree and stand conditions, including insect-killed timber (Lowell and Willits 1998, Parry et al. 1996, Plank 1984), small-diameter trees (Lowell and Green 2001), fire-killed timber (Lowell et al. 1992), and wind-damaged timber (Aho and Cahill 1984).

Relatively few studies have been conducted on product (or lumber) recovery from western hardwood species. Pfeiffer and Wollin (1954) conducted a recovery study based on data from 472 red alder logs harvested in Oregon. The logs processed in this study were 8 feet long with top diameters ranging from 10 to 24

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inches. All material was graded using NHLA grading rules, as they existed at the time of the study. In this noted study, it was concluded that the percentage yield of No. 1 Common and Better material from red alder was comparable to those for eastern hardwood species.

Plank et al. (1990) conducted a study based on a sample of 159 red alder trees growing on lands administered by the U.S. Department of the Interior, Bureau of Land Management and USDA Forest Service in the coastal range of northwest Oregon. These trees ranged in size from 12 to 28 inches diameter at breast height and were from 49 to 116 feet tall. Average age was 66 years with individual stems varying from 31 to 102 years.

The long logs in Plank's 1990 study were bucked into lengths of 8, 10, and 12 feet for processing. The preferred length was 10 feet. The bucking process resulted in 986 short logs for mill processing. These logs had top scaling diameters that ranged from 6 to 23 inches. Twenty-three percent of the logs were in the 5- to 9-inch scaling class. In this study, logs with less than 10 inches scaling diameter and all center cants were sawn into pallet material. The target thickness for rough green lumber was reported as 1.33 inches.

The LRF (ratio of board feet of lumber tally per net cubic foot of log input) for logs in the 9-inch-and-larger diameter class ranged from 4.3 to 4.4 board feet. Regression equations were developed to calculate grade recover (percentage of recovery values) as a function of log diameters, and the reported recovery values resulting from the regression equations were the basis yield estimates. In this study, it was estimated that recovery of the two highest grades of lumber (Select and No. 1 Shop) increased from 4 percent for 7-inch logs to 88 percent for 23-inch logs (Plank et al. 1990).

This group also conducted a second study using 153 red alder trees that were harvested from the northwest Washington land administered by the Washington State Department of Natural Resources and the Darrington Ranger District of the Mount Baker-Snoqualmie National Forest. Both of the studies use the same schema for data collection and log measurement (Plank and Willits 1994).

The trees in the Washington study were slightly younger, but of a similar diameter range. The Washington material was also processed in a mill with a band headrig that resulted in a kerf of 0.175 inches as opposed to the circular headrig used in the Oregon study that had a kerf of 0.325 inches. The mill in Oregon had an optimizer edger. A resaw was used in the Washington mill. Slightly higher grade recovery values were obtained in the Washington study. The raw data for this study

were located in the archives of the USDA Forest Service, Pacific Northwest Research Station. Limited information has been published from the Washington study.

## Processing Alder Lumber

Brunner et al. (1996) compared five edging practices on three grades of red alder lumber and found considerable volume differences between edging practices for each lumber grade. These edging strategies for red alder lumber indicated that significant revenues could be generated in large sawmills by removing less material during edging (Green et al. 1995). For example, a vertically integrated sawmill using 20 million board feet could potentially increase its revenues by \$2 million by simply practicing less severe edging (Brunner et al. 1997).

## Site Selection

Only sites located on the Ketchikan road system were considered for sampling in this project to eliminate the added expenses associated with barging logs from remote locations. Two potential sites were located. The sites were considered typical of alder stands in southeast Alaska, as alder is commonly regenerated on sites with a high degree of soil disturbance.

## Procedures and Methods

Four, tenth-acre (0.10) plots (0.4 hectare) were located on each site. On each plot, all trees above 6 inches d.b.h. were measured. The standing tree height, measured by ocular estimate, averaged 69 feet and ranged from 61 to 82 feet. The trees on site 1 averaged 26 years of age. Stand elevation was 525 feet above sea level. The trees on site 2 averaged 46 years of age and were 216 feet above sea level. Site 1 was located 3 miles from Wards Cove. Site 2 was 10 miles. Stem counts and average breast height diameters for each size class range are included in table 1.

## Log Selection

Forty-four trees from the 46-year-old alder site were selected for this study. These trees were cut and bucked into long-length logs. The trees were topped at the point where the stem degenerated into multiple sections or a 6-inch top. The logs were yarded to the roadside and trucked to the Ketchikan Wood Technology Center (KWTC) in Wards Cove, Alaska.

**Table 1—Characteristics of saw log samples harvested near Wards Cove, Alaska**

| <b>D.b.h. class<br/>range</b> | <b>Diameter</b> | <b>Site 1</b>         | <b>Site 2</b> |
|-------------------------------|-----------------|-----------------------|---------------|
| ----- <i>Inches</i> -----     |                 | <i>Stems per acre</i> |               |
| 6.6-7.5                       | 7               | 10                    | 3             |
| 7.6-8.5                       | 8               | 35                    | 3             |
| 8.6-9.5                       | 9               | 43                    | 23            |
| 9.6-10.5                      | 10              | 25                    | 20            |
| 10.6-11.5                     | 11              | 8                     | 10            |
| 11.6-12.5                     | 12              | 3                     | 18            |
| 12.5-13.5                     | 13              |                       | 20            |
| 13.6-14.5                     | 14              |                       | 8             |
| 14.6-15.5                     | 15              |                       | 5             |
| 15.6 +                        | 16              |                       | 5             |
| Total                         |                 | 124                   | 115           |
| Average d.b.h. (in)           |                 | 8.9                   | 11.4          |
| Age (years)                   |                 | 26                    | 46            |
| Elevation (ft)                |                 | 525                   | 216           |

d.b.h. = diameter at breast height.

## Log Sample Measurements

The delivered logs were unloaded and placed on bunk logs in the wood yard at the KWTC facility. All tree-length sections were scaled as long logs by Forest Service personnel using the USDA Forest Service, Region 10 Scaling Regulations (USDA FS 2004, Westside Log Scaling Handbook [NWLRA 2003]) to obtain estimates of board foot (Scribner C) volumes. Cubic content was obtained using the national forest cubic scaling methods (USDA FS 1991).

Volume was also calculated using stem analysis methods. Diameter measurements were taken at the butt; outside the bark at 2 feet from the butt; outside the bark at 4 feet from the butt (assuming a 6-inch stump, the measurement at this position can be assumed as d.b.h.); and, at 4-foot intervals (8, 12, 16, 20, etc.) up the stem. The odd length of the residual top section (residual top) and the top diameter in inches (inside the bark) were recorded. Bark thickness measurements were taken at the butt and top. Using these thickness and the associated diameter measurements, a regression equation was generated to allow adjustment of outside bark measurements to bark-free measurements. Volume was calculated for each section and total stem volume based on the sum of the section volumes. This method results in estimation of stem volume that is not significantly different when

compared to volumes obtained by water displacement (Husch et al. 1982, Young et al. 1967). Table 2 reports average stem characteristics for each scaling method (stem length; top diameter; gross and net scale Scribner C; gross and net cubic scale volume USDA Forest Service cubic method; gross cubic volume from the stem analysis measurements; and weight, grouped by d.b.h. class).

Once the long-length sections were scaled and measured, all material was bucked (merchandized) into short, mill-length logs. In accordance with current industry practices, the logs were cut into 8- and 10-foot lengths for sawing. The short logs were scaled and graded in accordance with the above-cited scaling procedures to obtain estimates of both board foot volume (Scribner C) and USDA Forest Service cubic foot values. All short logs were assigned numbers using a coding system that allowed identification of the long log of origin and position (butt, middle, top) within the long log.

## Log Processing

Primary breakdown was done using the KWTC thin-kerf band mill. In the breakdown process, one or two “jacket boards” were cut from the best opening face. The log was then turned 90 degrees and one or two additional boards were sawn. The

**Table 2—Stem characteristics of long logs by diameter at breast height (d.b.h.) class**

| D.b.h.<br>class | Stems         | Average<br>length | Average<br>top dib | Gross<br>volume<br>stem<br>analysis | Weight        | Scribner C            |                       | USDA FS cubic<br>scale |                       |
|-----------------|---------------|-------------------|--------------------|-------------------------------------|---------------|-----------------------|-----------------------|------------------------|-----------------------|
|                 |               |                   |                    |                                     |               | Gross<br>LL           | Net LL                | Gross<br>LL            | Net LL                |
| <i>Inches</i>   | <i>Number</i> | <i>Feet</i>       | <i>Inches</i>      | <i>Cubic<br/>feet</i>               | <i>Pounds</i> | <i>Board<br/>feet</i> | <i>Board<br/>feet</i> | <i>Cubic<br/>feet</i>  | <i>Cubic<br/>feet</i> |
| 8.6-9.5         | 6             | 36.7              | 6.5                | 12.1                                | 619           | 55                    | 35                    | 11.2                   | 8.6                   |
| 9.6-10.5        | 10            | 36.0              | 6.9                | 13.7                                | 717           | 58                    | 43                    | 12.7                   | 10.5                  |
| 10.6-11.5       | 10            | 39.8              | 7.4                | 17.9                                | 961           | 71                    | 56                    | 16.7                   | 13.1                  |
| 11.6-12.5       | 2             | 39.0              | 7.9                | 19.0                                | 945           | 70                    | 50                    | 16.9                   | 13.6                  |
| 12.6-13.5       | 5             | 43.0              | 7.6                | 24.9                                | 1,341         | 94                    | 82                    | 22.4                   | 19.8                  |
| 13.6-14.5       | 5             | 41.8              | 7.8                | 28.9                                | 1,505         | 98                    | 72                    | 23.0                   | 18.1                  |
| 14.6-15.5       | 4             | 40.5              | 9.6                | 33.7                                | 1,673         | 115                   | 83                    | 27.2                   | 22.1                  |
| 15.6-16.5       | 1             | 44.0              | 9.0                | 36.8                                | 1,870         | 130                   | 110                   | 29.3                   | 28.1                  |
| 16.6-17.5       | 1             | 43.0              | 8.6                | 38.4                                | 1,986         | 130                   | 130                   | 31.0                   | 20.8                  |
| Total           | 44            | 1,729.0           |                    | 905.8                               | 47,162        | 3,440                 | 2,640                 | 790.2                  | 641.4                 |
| Average         |               | 39.3              | 7.5                | 20.6                                | 1,072         | 78                    | 60                    | 18.0                   | 14.6                  |

LL = long length logs.

dib = diameter inside bark.

log was again turned 90 degrees, and all remaining boards were live sawn from this position. Denig and Wengert (2005) referred to this method as “cant” sawing. All lumber was sawn to a nominal thickness of 4/4 or 1 inch (actual rough and green target thickness of 1 and 1/16 inches-1.0625). All boards were coded and tallied so that each board could be identified as to tree and long log and short log number of origin.

## Lumber Processing

All boards were edged to nominal widths of 4 or 6 inches to allow production of dry, surfaced material in accordance with section 2.12.3.3 of National Hardwood Lumber Association (2007). Edged boards were rough trimmed to produce final lengths of 5, 6, 7, 8, 9, or 10 feet. Ninety percent of the boards were either 8- or 10-foot lengths. All information relative to widths and lengths were recorded. The fresh-sawn lumber was allowed to sit outside (uncovered) for 4 days to induce a desired level of color change (oxidation period). The period of oxidation was based on recommendations by personnel from Cascade Hardwood LLC, a producer of red alder lumber in Chehalis, Washington.

All lumber was dried in a commercial, low-pressure steam dry kiln at KWTC. The lumber was dried at a dry bulb temperature of 140 degrees Fahrenheit (°F) throughout the drying cycle to a final target moisture content of 9 percent (ovendry basis). Based on a review of available kiln drying schedules (Simpson 1991) and recommendations from personnel at Cascade Hardwood, a 5-day drying cycle was used, as follows:

- Day 1 (5 °F wet-bulb depression)
- Day 2 (5 °F wet-bulb depression)
- Day 3 (10 °F wet-bulb depression)
- Day 4 (15 °F wet-bulb depression)
- Day 5 (equalization period)

Upon completion of drying, the material was planed to a thickness of 0.75 inch (3/4 inch) and graded.

## Lumber Grading

In this project, grading was done using a piece-by-piece process that actually measured clear and sound areas (in practice these measurements are replaced by visual estimates as the material passes the inspector on a moving conveyor). Both sides of each piece of lumber were photographed using a digital camera. In the

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photographs, the lumber was placed beside a 12-foot measure so that the photographs can be recalibrated to scale. A database was prepared that related the grades in this project to the photographs. This database and photographs are available for future research projects concerned with red alder grade recovery.

As discussed in the literature review, the hardwood industry in the United States uses both NHLA and industry grades. In many instances, the industry or trade grades are groupings of NHLA grades or slight variation (specific defects and characteristics at variance to the NHLA grades may be allowed or not allowed) of the standard grades. Many mills put much of the lower end material into an industry-designated classification as “pallet” grade and NHLA does not recognize a pallet grade. These issues were discussed with representatives of Cascade Hardwoods who used grading that represented industry practice in use by their firm, thus the grades may differ from the NHLA standard grades. The grades used by Cascade Hardwoods are available on their Web site (Cascade 2008).

## Product Valuation

Price data for most hardwood lumber products are reported weekly by the Hardwood Market Report (HMR) (HMR 2007). Unfortunately, quoted prices for red alder are not included in the HMR report. The ownership of the red alder industry is concentrated, which limits price quotations to a few producers. This study presents prices common to the trade during the conduct of the study in the fall and winter of 2007.

The residual products from red alder (chips, sawdust, and planing waste) can be used in fiber production processes, as fuel in renewable energy applications, and for a number of other specialty uses. The specialty uses include sawdust-size particles for fish smoking and planks (produced by cutting up low-grade boards) for barbecuing and baking fish, especially salmon. No attempt has been made to include the value of these secondary products in this study.

## Results and Discussion

### Log Measurements

Long logs bucked into short logs (8 feet or 10 feet in length) and reported as short log board foot Scribner C scale volumes and USDA Forest Service cubic scale volume sorted by d.b.h. class are presented in table 3.

Based on the scale measurements from long logs, the gross scale of the average tree in the study contained 78 board feet when scaled with the Scribner C log rule.

**Table 3—Stem characteristics of short logs (SL), by diameter at breast height (d.b.h.)**

| D.b.h. class       | Stems        | Short logs<br>(SL)  | Average SL<br>per stem | Scribner C              |        | USDA FS cubic scale       |        |
|--------------------|--------------|---------------------|------------------------|-------------------------|--------|---------------------------|--------|
|                    |              |                     |                        | Gross SL                | Net SL | Gross SL                  | Net SL |
| <i>Inches</i>      | <i>-----</i> | <i>Number -----</i> |                        | <i>-- Board feet --</i> |        | <i>--- Cubic feet ---</i> |        |
| 8.6-9.5            | 6            | 23                  | 3.8                    | 42                      | 38     | 10.7                      | 9.7    |
| 9.6-10.5           | 10           | 39                  | 3.9                    | 49                      | 46     | 12.2                      | 11.2   |
| 10.6-11.5          | 10           | 42                  | 4.2                    | 63                      | 59     | 15.3                      | 14.0   |
| 11.6-12.5          | 2            | 8                   | 4.0                    | 70                      | 65     | 16.2                      | 14.9   |
| 12.6-13.5          | 5            | 21                  | 4.2                    | 96                      | 84     | 22.2                      | 19.4   |
| 13.6-14.5          | 5            | 23                  | 4.6                    | 112                     | 102    | 23.6                      | 20.0   |
| 14.6-15.5          | 4            | 17                  | 4.2                    | 145                     | 115    | 29.0                      | 24.3   |
| 15.6-16.5          | 1            | 5                   | 5                      | 170                     | 170    | 33.1                      | 32.2   |
| 16.6-17.5          | 1            | 5                   | 5                      | 150                     | 130    | 31.9                      | 27.5   |
| Total <sup>a</sup> | 44           | 183                 |                        | 3,450                   | 3,100  | 782.0                     | 693.3  |
| Average            |              |                     | 4.2                    | 78                      | 70     | 17.8                      | 15.8   |

<sup>a</sup> Totals for gross and net SLs are for all stems.

Net scale was 60 board feet. Weighted average sample tree d.b.h. was 11.2 inches. The gross scale based on summation of short logs was the same as that for long logs. The net scale of short logs (Scribner C), however, was 70 board feet—a value 17 percent higher than that for long logs. This difference between the average long and short log net scale (Scribner C) is explained by the fact that the merchandizing process eliminated some defective sections not suitable for sawing.

### Lumber Volume and Grade Recovery by Tree, Long and Short Log Lengths

The 44 long logs produced 183 short logs that were 8 feet (74 logs) or 10 feet (109 logs) long. Each log included a trim allowance of 2 to 4 inches. Basic characteristics and resulting tally of lumber by grade for each log diameter class in inches is reported in table 4. The same information is presented in table 5, but it is sorted and reported by gross Scribner C scale class. Table 6 has been included for reference purposes to show percentage of recovery by grade for each scaling class. Average top diameter of all mill length logs was 8.2 inches. The gross scale of the average mill length log was 19 board feet Scribner C. Net scale of these logs is 17 board feet Scribner C. The recovery percentage of the top two grades of lumber (top grade defined as Superior and second highest grade as Cabinet and Custom) is less than those reported from other studies. The primary reason for this is the inclusion of many small logs.

Table 4—Scale and tally by grade for 8- and 10-foot Alaska red alder saw logs, accumulated by scaling diameter class of tree-length sections

| Scribner C                                 |        |                | USDA FS cubic scale |                | Tally    |                |                         |             |       |               |        |            |
|--------------------------------------------|--------|----------------|---------------------|----------------|----------|----------------|-------------------------|-------------|-------|---------------|--------|------------|
| Scaling diameter                           | Logs   | Avg. gross     | Avg. net            | Avg. gross     | Avg. net | Superior       | Cabinet and custom shop | Common shop | Frame | Economy frame | Pallet | All grades |
| Inches                                     | Number | — Board feet — |                     | — Cubic feet — |          | — Board feet — |                         |             |       |               |        |            |
| 6                                          | 41     | 10             | 10                  | 2.36           | 2.19     | 0.29           | 0.88                    | 2.48        | 10.17 | 2.61          | 2.41   | 18.85      |
| 7                                          | 39     | 10             | 10                  | 3.28           | 3.02     | 1.99           | 4.03                    | 4.75        | 11.84 | 1.98          | 1.04   | 25.63      |
| 8                                          | 38     | 16             | 13                  | 3.99           | 3.54     | 2.18           | 4.59                    | 6.46        | 14.65 | 2.68          | 1.73   | 32.29      |
| 9                                          | 23     | 20             | 19                  | 4.83           | 4.06     | 4.30           | 7.71                    | 7.26        | 16.63 | 1.93          | 0.91   | 38.75      |
| 10                                         | 17     | 30             | 26                  | 5.82           | 5.15     | 4.90           | 10.82                   | 9.40        | 19.72 | 1.92          | 1.05   | 47.81      |
| 11                                         | 12     | 34             | 28                  | 6.65           | 5.77     | 6.50           | 14.15                   | 10.61       | 16.56 | 5.01          | 1.22   | 54.06      |
| 12                                         | 8      | 45             | 40                  | 8.19           | 6.94     | 12.25          | 17.48                   | 10.56       | 17.63 | 4.92          | 1.73   | 65.25      |
| 13                                         | 5      | 58             | 52                  | 10.02          | 9.10     | 28.87          | 26.14                   | 9.53        | 13.40 | 1.00          | 1.33   | 80.27      |
| Total                                      | 183    |                |                     |                |          |                |                         |             |       |               |        |            |
| Average values for all 8- and 10-foot logs |        |                |                     |                |          |                |                         |             |       |               |        |            |
| 8.2                                        |        | 18.85          | 16.94               | 4.27           | 3.79     | 3.69           | 6.39                    | 6.11        | 13.99 | 2.56          | 1.53   | 34.29      |
|                                            |        |                |                     |                |          | 10.8%          | 18.6%                   | 17.8%       | 40.8% | 7.5%          | 4.5%   | 99.9%      |

Table 5—Scale and lumber recovery tally by grade for 8- and 10-foot Alaska red alder saw logs, accumulated by gross scale class of logs

| Scribner C<br>scale class | USDA FS<br>cubic scale |       | Tally             |            |                         |          |         |                    |        |       |         |        |  |
|---------------------------|------------------------|-------|-------------------|------------|-------------------------|----------|---------|--------------------|--------|-------|---------|--------|--|
|                           | Gross                  | Net   | Average<br>length | 1-Superior | 2-Cabinet<br>and custom | 3-Custom | 4-Frame | 5-Economy<br>frame | Pallet | Total | Logs    |        |  |
| — Board feet —            |                        |       | — Cubic feet—     |            | — Board feet —          |          |         |                    |        |       |         | Number |  |
| 10                        | 10                     | 2.9   | 2.7               | 9.0        | 1.0                     | 2.8      | 3.7     | 11.5               | 2.3    | 1.7   | 23.0    | 94     |  |
| 20                        | 17                     | 4.6   | 3.9               | 9.7        | 3.7                     | 6.1      | 7.4     | 15.8               | 2.5    | 1.3   | 36.8    | 47     |  |
| 30                        | 25                     | 5.9   | 5.2               | 8.8        | 5.3                     | 11.8     | 9.4     | 19.0               | 2.1    | 1.2   | 48.8    | 24     |  |
| 40                        | 36                     | 7.3   | 6.3               | 9.1        | 7.0                     | 15.2     | 14.1    | 15.7               | 6.1    | 1.5   | 59.5    | 9      |  |
| 50                        | 42                     | 9.1   | 7.4               | 9.6        | 13.7                    | 22.5     | 6.9     | 17.3               | 5.5    | 0.7   | 66.5    | 5      |  |
| 60                        | 55                     | 10.4  | 9.8               | 10.0       | 36.1                    | 22.8     | 8.3     | 14.8               | 1.3    | 1.7   | 84.8    | 4      |  |
| Total of all logs         |                        |       |                   |            |                         |          |         |                    |        |       |         |        |  |
| 3,450                     | 3,100                  | 782.0 | 693.3             | 1,682.0    | 675.2                   | 1,169.2  | 1,118.8 | 2,559.8            | 467.7  | 279.3 | 6,270.0 | 183    |  |
| Average short-log values  |                        |       |                   |            |                         |          |         |                    |        |       |         |        |  |
| 18.85                     | 16.95                  | 4.27  | 3.79              | 9.19       | 3.69                    | 6.39     | 6.11    | 13.99              | 2.56   | 1.53  | 34.29   |        |  |
|                           |                        |       |                   |            | 10.8%                   | 18.6%    | 17.8%   | 40.8%              | 7.5%   | 4.5%  | 99.9%   |        |  |

**Table 6—Scale and percentage of lumber grade recovery tally, by grade, for 8- and 10-foot Alaska red alder saw logs, accumulated by gross scale value**

| Gross<br>Scribner<br>C scale | Gross<br>cubic<br>scale | Percentage of tally (board feet) |                         |          |         |                    |        | Total | Logs          |
|------------------------------|-------------------------|----------------------------------|-------------------------|----------|---------|--------------------|--------|-------|---------------|
|                              |                         | 1-Superior                       | 2-Cabinet<br>and custom | 3-Custom | 4-Frame | 5-Economy<br>frame | Pallet |       |               |
| <i>Board<br/>feet</i>        | <i>Cubic<br/>feet</i>   | <i>Percent</i>                   |                         |          |         |                    |        |       | <i>Number</i> |
| 10                           | 2.9                     | 4.5                              | 12.0                    | 16.2     | 49.9    | 10.0               | 7.5    | 100.0 | 94            |
| 20                           | 4.6                     | 10.1                             | 16.5                    | 20.2     | 42.8    | 6.7                | 3.7    | 100.0 | 47            |
| 30                           | 5.9                     | 10.9                             | 24.3                    | 19.2     | 38.9    | 4.2                | 2.5    | 100.0 | 24            |
| 40                           | 7.3                     | 11.8                             | 25.5                    | 23.6     | 26.3    | 10.3               | 2.5    | 100.0 | 9             |
| 50                           | 9.1                     | 20.7                             | 33.8                    | 10.3     | 26.0    | 8.2                | 1.0    | 100.0 | 5             |
| 60                           | 10.4                    | 42.5                             | 26.8                    | 9.8      | 17.4    | 1.5                | 2.0    | 100.0 | 4             |
| Total of all logs<br>3,450   | 782.0                   | 10.8                             | 18.6                    | 17.8     | 40.8    | 7.5                | 4.5    | 100.0 | 183           |

**Table 7—Alaska red alder short log recovery factors**

| Gross<br>Scribner<br>C scale | Net<br>Scribner<br>C scale | Net<br>cubic<br>scale | Average<br>length | Total<br>lumber tally<br>from log | Dry<br>planed lumber<br>output/ log | Logs          | Overrun<br>(of net<br>log scale) | CRR  | LRF  |
|------------------------------|----------------------------|-----------------------|-------------------|-----------------------------------|-------------------------------------|---------------|----------------------------------|------|------|
| ---                          | ---                        | <i>Cubic<br/>feet</i> | <i>Feet</i>       | <i>Board<br/>feet</i>             | <i>Cubic<br/>feet</i>               | <i>Number</i> | <i>Percent</i>                   |      |      |
| 10                           | 10                         | 2.7                   | 9.0               | 23                                | 1.26                                | 94            | 130                              | 0.47 | 8.52 |
| 20                           | 17                         | 3.9                   | 9.7               | 36.8                              | 2.08                                | 47            | 113                              | 0.53 | 9.44 |
| 30                           | 25                         | 5.2                   | 8.8               | 48.8                              | 2.77                                | 24            | 95                               | 0.53 | 9.38 |
| 40                           | 36                         | 6.3                   | 9.1               | 59.5                              | 3.37                                | 9             | 65                               | 0.54 | 9.44 |
| 50                           | 42                         | 7.4                   | 9.6               | 66.5                              | 3.78                                | 5             | 58                               | 0.51 | 8.99 |
| 60                           | 55                         | 9.8                   | 10.0              | 84.8                              | 4.82                                | 4             | 54                               | 0.49 | 8.65 |
| Total of<br>all logs         | 3,100                      | 693.3                 |                   | 6,270                             | 351.19                              | 183           | 102                              | 0.51 | 9.04 |

CRR = cubic recovery ratio (cubic feet dry lumber/cubic feet log input).

LRF = lumber recovery factor (board feet of lumber/net cubic feet input).

## Overrun Percentage, Cubic Recovery Ratio, and Lumber Recovery Factors

Presented in table 7 are overrun, CRR, and LRF for short log lengths. The CRR is the ratio of cubic foot planed and surfaced lumber per net cubic foot of log input. The LRF is the number of board feet of lumber tally/net cubic foot content of the input logs. This information has been aggregated by gross scale class so that it may be compared with similar-size logs from studies from other regions. The factors reported in table 7 are higher than any of the other studies referenced in the report.

It is the authors' opinion that in a production environment, some of the lower grade material produced by this study might have been sent to the chipper.

## Lumber Value

The price information in table 8 was obtained by personnel at the KWTC and is presented as those common to the trade during the study. Table 8 also includes a column that compares the increase in value of the scale class over the previous class. Growth information for each log class is not available, but this information provides general information on the increase in value of the logs that result from allowing it to grow to the next class.

Using the above prices, the value of the material freight on board (f.o.b.) mill was \$822 per thousand board feet (mbf) produced. The information in table 8 has been summarized by gross scale class so that the values of logs by assigned scale class are available. No attempt has been made to report the value of specialty products that may be derived from red alder sawdust and chips.

## Comparison Yields With Other Studies

Any comparison of the red alder recovery studies from Alaska, Washington, and Oregon must recognize the differences that exist between sample characteristics, production systems, product, and applied grading rules. Older trees and larger logs were studied in the Washington and Oregon recovery studies (Plank and Willits 1994, Plank et al. 1990). These studies also were conducted in mills with thicker saws that produced more sawdust. Thickness of the rough green material in Alaska was 4/4 inch as opposed to 5/4 in Washington and Oregon.

Grade recovery in the 20- to 60-board-foot class (percentage by grade) for tallied Alaska material is presented in table 9. Similar information from the Washington study, adjusted to the scale distribution for the Alaska logs is presented in table 10. Table 11 presents a direct comparison of recovered materials from the Alaska and Washington recovery studies.

Recovery ratios and LRF from a number of sources and this study are presented in table 12. The Alaska values are considerably higher than those for published studies conducted in Washington and Oregon. Equipment used by producers (thin-kerf vs. thick-kerf saws) is responsible for some of the differences. As these numbers are considered, it must be recognized that there were changes to the NHLA grading rules in January 2007. In general, the 2007 changes were designed so that the new rules are more aligned with industry practice.

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**Recovery ratios and LRF Alaska values are considerably higher than those for published studies conducted in Washington and Oregon.**

**Table 8—Average recovery (dollars) by gross scale class (Scribner C—short logs) for all study material**

| Gross<br>Scribner<br>C scale | 1-Superior | 2-Cabinet<br>and custom | 3-Common<br>shop | 4-Frame | 5-Economy<br>frame | 6-Pallet | Value<br>lumber<br>tally<br>from<br>log | Increase<br>in value<br>by growing<br>log to next<br>class | Logs in<br>study | Value<br>from<br>study<br>logs | Value/mbf<br>of tally<br>from log |
|------------------------------|------------|-------------------------|------------------|---------|--------------------|----------|-----------------------------------------|------------------------------------------------------------|------------------|--------------------------------|-----------------------------------|
|                              | -----      | -----                   | -----            | -----   | -----              | -----    | Dollars                                 | Percent                                                    | Number           | Dollars                        | Dollars/mbf                       |
| \$/MBF—→ <sup>a</sup>        | 2,425      | 1,113                   | 550              | 550     | 325                | 150      |                                         |                                                            |                  |                                |                                   |
| 10                           | 2.49       | 3.06                    | 2.05             | 6.30    | 0.74               | 0.26     | 14.90                                   | 98.56                                                      | 94               | 1,400                          | 648                               |
| 20                           | 9.04       | 6.77                    | 4.09             | 8.68    | 0.80               | 0.20     | 29.58                                   | 43.69                                                      | 47               | 1,390                          | 803                               |
| 30                           | 12.87      | 13.18                   | 5.16             | 10.44   | 0.67               | 0.19     | 42.50                                   | 23.53                                                      | 24               | 1,020                          | 871                               |
| 40                           | 17.06      | 16.87                   | 7.73             | 8.62    | 2.00               | 0.22     | 52.50                                   | 39.96                                                      | 9                | 473                            | 882                               |
| 50                           | 33.30      | 25.03                   | 3.78             | 9.50    | 1.78               | 0.10     | 73.48                                   | 71.69                                                      | 5                | 367                            | 1,105                             |
| 60                           | 87.50      | 25.31                   | 4.58             | 8.11    | 0.41               | 0.25     | 126.16                                  |                                                            | 4                | 505                            | 1,487                             |
| Total value                  | 1,637      | 1,301                   | 615              | 1,408   | 152                | 42       | 5,155                                   |                                                            | 183              | 5,155                          |                                   |
| Percent<br>of total          | 31.8%      | 25.2%                   | 11.9%            | 27.3%   | 2.9%               | 0.8%     | 100.0%                                  | Average dollars/mbf<br>tally                               |                  |                                |                                   |
|                              |            |                         |                  |         |                    |          |                                         |                                                            |                  | \$822                          |                                   |

<sup>a</sup> Note: Value based upon information obtained by personnel at Ketchikan Wood Technology Center on January 7, 2007 (kiln-dried material).

**Table 9—Percentage of grade recovery from Alaska red alder logs adjusted for comparison with Washington state data (see table 11)**

| Gross log<br>scale class | 1-Superior     | 2-Cabinet<br>and custom | 3-Custom | 4-Frame | 5-Economy<br>frame | 6-Pallet | Total         | Logs |
|--------------------------|----------------|-------------------------|----------|---------|--------------------|----------|---------------|------|
| <i>Board feet</i>        | <i>Percent</i> |                         |          |         |                    |          | <i>Number</i> |      |
| 10                       | 4.5            | 12.0                    | 16.2     | 49.9    | 10.0               | 7.5      | 100.0         | 94   |
| 20                       | 10.1           | 16.5                    | 20.2     | 42.8    | 6.7                | 3.7      | 100.0         | 47   |
| 30                       | 10.9           | 24.3                    | 19.2     | 38.9    | 4.2                | 2.5      | 100.0         | 24   |
| 40                       | 11.8           | 25.5                    | 23.6     | 26.3    | 10.3               | 2.5      | 100.0         | 9    |
| 50                       | 20.7           | 33.8                    | 10.3     | 26.0    | 8.2                | 1.0      | 100.0         | 5    |
| 60                       | 42.5           | 26.8                    | 9.8      | 17.4    | 1.5                | 2.0      | 100.0         | 4    |
| Weighted average         |                |                         |          |         |                    |          |               |      |
| 20 to 60                 | 12.5           | 21.0                    | 19.3     | 38.0    | 6.2                | 3.0      | 100.0         | 89   |
| 10 to 60                 | 10.8           | 18.6                    | 17.8     | 40.8    | 7.5                | 4.5      | 100.0         | 183  |

**Table 10—Percentage of grade recovery from Washington red alder adjusted for comparison with Alaska red alder data (see table 11)**

| Gross log<br>scale class | 1-Select       | 2-No. 1 Shop | 3-No. 2 Shop | 4-No. 3 Shop | 5-Frame | 6-Skip | Total         | Logs |
|--------------------------|----------------|--------------|--------------|--------------|---------|--------|---------------|------|
| <i>Board feet</i>        | <i>Percent</i> |              |              |              |         |        | <i>Number</i> |      |
| 10                       | 15.3           | 7.9          | 10.8         | 33.2         | 32.8    | 0.0    | 100.0         | 94   |
| 20                       | 12.3           | 22.0         | 17.5         | 14.3         | 31.8    | 2.2    | 100.0         | 47   |
| 30                       | 17.5           | 27.6         | 19.5         | 11.2         | 23.2    | 1.0    | 100.0         | 24   |
| 40                       | 20.4           | 28.2         | 19.2         | 11.2         | 18.6    | 2.4    | 100.0         | 9    |
| 50                       | 22.9           | 29.8         | 16.7         | 11.3         | 17.5    | 1.8    | 100.0         | 5    |
| 60                       | 25.4           | 28.3         | 16.9         | 10.6         | 17.8    | 0.9    | 100.0         | 4    |
| Weighted average         |                |              |              |              |         |        |               |      |
| 20 to 60                 | 15.7           | 24.9         | 18.1         | 12.8         | 26.7    | 1.8    | 100.0         | 89   |
| 10 to 60                 | 15.5           | 16.1         | 14.4         | 23.3         | 29.8    | 0.9    | 100.0         | 183  |

**Table 11—Comparison of tally of recovered lumber grades, gross scale classes 20 to 60 board feet (Washington logs adjusted to Alaska log scale distribution)**

|                                                      | Sum top<br>3 grades | Sum 4+5+6<br>grades | 6 Bottom | Total |
|------------------------------------------------------|---------------------|---------------------|----------|-------|
|                                                      | <i>Percent</i>      |                     |          |       |
| Alaska (distribution as<br>delivered for test)       | 52.8                | 47.2                | 3.0      | 100.0 |
| Washington logs (adjusted<br>to Alaska distribution) | 58.7                | 41.3                | 1.8      | 100.0 |

Table 12—Comparison of recovery ratio, cubic recovery, and board foot tally/cubic foot of log import for Alaska red alder with information from several other studies

| Source                      | Species/<br>location                                 | Raw material<br>form            | Overrun <sup>a</sup> | Cubic<br>recovery<br>(CRR) <sup>b</sup> | Product                  | Lumber<br>recovery<br>factor<br>(LRF) <sup>c</sup> | Nominal<br>thickness         |
|-----------------------------|------------------------------------------------------|---------------------------------|----------------------|-----------------------------------------|--------------------------|----------------------------------------------------|------------------------------|
| Plank 1984                  | Lodgepole pine                                       | 8 foot Stud Logs                | 138                  | 37                                      | 2x4 dimension            | 6.30                                               | Dimension 2 inch             |
| Kilborn 2002                | Softwood species/<br>Alaska mills                    | All mill lengths                | —                    | —                                       | All sizes<br>and species | 6.38                                               | Dimension 2 inch             |
| Kilborn 2002                | Mills/Lower 48                                       | All mill lengths                | —                    | —                                       | All sizes<br>and species | 7.75                                               | Dimension 2 inch             |
| Kilborn 2002                | Estimate for<br>modern mills in<br>Pacific Northwest | All mill lengths                | —                    | —                                       | All sizes<br>and species | 9.00                                               | Dimension 2 inch             |
| Plank et al. 1990           | Red alder/Oregon                                     | Tree length<br>long logs        | 123                  | 42                                      | Hardwood lumber          | —                                                  | Adjusted to 5/4 <sup>d</sup> |
| ESP Washington <sup>e</sup> | Red alder/<br>Washington                             | Long lengths                    | 112                  | 41                                      | Hardwood lumber          | 5.25                                               | Adjusted to 5/4 <sup>d</sup> |
| ESP Washington <sup>e</sup> | Red alder/<br>Washington                             | Mill length 8, 10,<br>and 12 ft | 112                  | 43                                      | Hardwood lumber          | 5.84                                               | Adjusted to 5/4 <sup>d</sup> |
| Southeast Alaska            | Red alder/Alaska                                     | Long lengths                    | 236                  | 61                                      | Hardwood lumber          | 9.79                                               | 4/4                          |
| Southeast Alaska            | Red alder/Alaska                                     | Short logs 8, 10 ft             | 202                  | 57                                      | Hardwood lumber          | 9.00                                               | 4/4                          |

— = no data available.

ESP = Ecologically Sustainable Production of Forest Resources Team, Human and Natural Resources Interactions Group, Pacific Northwest Research Station.

<sup>a</sup> Recovery ratio = ((lumber tally volume—net board foot scale) / net board foot scale) x 100.

<sup>b</sup> Cubic recovery = cubic lumber volume divided by net cubic log volume times 100.

<sup>c</sup> Lumber recovery factor = board foot tally/net cubic foot log input.

<sup>d</sup> The thickness of the rough, green material was 1.33 inches. Given this size, it could have been dried and planed to 1-1/16, the dry dimension resulting from 5/4. It has been adjusted to this thickness for purposes of this report.

<sup>e</sup> Derived from unpublished data referred to by Plank and Willits 1994.

## Conclusions

### Scaling Methods

The scaling methods used in Alaska are designed for measuring large old-growth logs. The methods are biased, however, when applied to small-diameter and short-length logs. In an economic sense, the methods of measurement are standards of trade, and the market determines the value of the material regardless of the system used to determine volume at various stages of production. However, when considered from the quality-control perspective, the methods of measurement may have an impact on recovery factors and ratios that are used to evaluate efficiency and to compare various production facilities and studies. It is certain that application of the USDA Forest Service cubic scaling methods (USDA FS 1991), when correctly applied, will underestimate the cubic content of all logs. For larger log sizes and lengths, the underestimation is not material (the percentage error is small), but in extremely small logs (short lengths of 8 and 10 feet and scaling diameters less than 10 inches), the differences may become significant if used for quality control and calculation of the various recovery factors. This fact must be recognized when using cubic scale estimates of content and any factor that includes cubic scale content. The basic reason for the underestimation is constant application of procedures that round down measurements. The constant rounding down results in underestimation of log cubic scale content and recovery factors that are slightly exaggerated.

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**Given the proper production system, Alaska has raw material that compares favorably with any that exists in the Pacific Northwest or Canada.**

### Measurement, Grade Yield, and Recovery

Published overrun, CRR, and LRF values from existing research reports are reported in table 12. In this study, the volumes of recovered lumber are comparable to those produced by the best and most modern mills in North America. In summary, given the proper production system, Alaska has raw material that compares favorably with any that exists in the Pacific Northwest or Canada.

For comparative purposes, table 13 presents quoted prices (Random Lengths Publications 2006) for forest products produced in the Pacific Northwest and other regions during this project. A review of the table indicates that at the time the logs were processed, red alder prices were 36 percent more than the index value for all shop and moulding grades of softwood lumber, and over twice the index values for softwood dimension lumber. Obviously, production of red alder from Alaska has the potential for a higher return than softwood products.

During the past two decades, there have been numerous improvements to sawmill systems that increase the material recovery and the rates of products that

**Table 13—Quoted price (Random Length Lumber Market Report, November 22, 2006) and estimated mill value of Alaska red alder**

| Composite price <sup>a</sup>           | Quoted price |           |          |
|----------------------------------------|--------------|-----------|----------|
|                                        | This week    | Last week | Year ago |
| <i>Dollars per thousand board feet</i> |              |           |          |
| Product:                               |              |           |          |
| Random-length dimension                | 271          | 270       | 349      |
| Stud                                   | 268          | 266       | 353      |
| Low-grade random dimension             | 166          | 166       | 239      |
| Board <sup>b</sup>                     | 490          | 490       | 538      |
| Shop, Moulding, and Better             | 604          | 604       | 682      |
| Coast dry random stud                  | 257          | 253       | 330      |
| Softwood species:                      |              |           |          |
| Inland                                 | 332          | 330       | 392      |
| Southern pine                          | 267          | 267       | 368      |
| Western S-P-F                          | 257          | 257       | 329      |
| Eastern S-P-F                          | 298          | 295       | 378      |
| Green Douglas-fir                      | 297          | 295       | 368      |
| Mill-run red alder from Alaska         | 822          |           |          |

S-P-F = Spruce-pine-fir species marketing group or mixture.

<sup>a</sup> RLPI November 22, 2006-source of all prices, except red alder.

<sup>b</sup> Listing of “board” in Random Lengths Publications (2006).

are produced. The technological improvements to the mills have also resulted in processing of smaller material that was previously left in the woods in the form of tops or produced into chips for fiber production. The small logs processed in this Alaska study, although not included in the Washington and Oregon studies in 1990 and 1991, are now being converted to lumber by many mills in the Lower 48 States. However, based on a comparison of sizes that are common to the three studies, it is concluded that grade yields of material from logs of common size are approximately equal. Increased material can be recovered by use of thin-kerf saws.

## Forest Management Implications

Harvesting under the 50-year licenses began in 1950. The resulting stands from these harvests are now approaching 50 years of age. These older stands are now ready for harvest, and there should be a continuing and sustainable supply of red alder for harvests in future years. The sustainable level of harvest is yet to be determined.

The focus of this study has been on the recovery of red alder lumber from logs in southeast Alaska. Limited reference information—relative to the quality of the site and age of the material—has been collected. It is obvious, however, as seen in table 9 that there are major increases in value (more superior-grade product) as the trees and logs grow from scale class 10 to 20 and again from 40 to 50. Although we have not investigated growth rates, it is anticipated that there would be a major increase in values if the tree were harvested between 50 to 60 years of age as opposed to the 46 years of the sample material. Additional site-specific research could determine optimum age for harvesting red alder in southeast Alaska.

Some landowners in southeast Alaska primarily interested in growing softwood have considered red alder as a weed species and have proposed controlling growth by application of herbicides. Given the rapid growth of red alder, the species has the potential to financially outperform softwoods that require longer rotations. Additional research specific to southeast Alaska could evaluate the potential of intensive management of red alder.

We are confident that the red alder in southeast Alaska is similar to red alder in other regions of the Pacific Coast. Although a considerable amount of small-diameter logs were included in this project, the effort failed to identify any unique characteristics or conditions that would create a competitive disadvantage in the market place.

The determination of the optimal size and location of industry infrastructure is subject to additional analyses that define the age structure, volumes, and growth rates at specific locations (manufacturing sites) within southeast Alaska. Interest (demand) from producers indicates that land managers on the Tongass National Forest need to determine sustainable levels of production.

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assistance of personnel who provided information about drying, dry kiln schedules, and grading at Cascade Hardwood, LLC (a producer of red alder lumber in Chehalis, Washington).

## **Metric Equivalents**

| <b>When you know:</b>    | <b>Multiply by:</b> | <b>To find:</b>      |
|--------------------------|---------------------|----------------------|
| Board feet, log scale    | 0.0045              | Cubic meters, logs   |
| Board feet, lumber scale | .0024               | Cubic meters, lumber |
| Inches                   | 2.54                | Centimeters          |
| Feet                     | .3048               | Meters               |
| Acres                    | .405                | Hectares             |
| Miles                    | 1.609               | Kilometers           |
| Degrees Fahrenheit       | .56(F-32)           | Degrees Celsius      |

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