

**Forest Service Handbook  
National Headquarters - Washington Office  
Washington, DC**

**Forest Service Handbook 2409.11a – National Forest Cubic Scaling Handbook  
Chapter 10 - General Scaling Requirements**

**Amendment:** 2409.11a-2002-2

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**Approved by:** Gloria Manning, Associate Deputy Chief, NFS

**Date approved:** April 25, 2002

**Responsible Staff:**

**Last Change:** 2409.11a-2002-1 to 2409.11a\_zero\_code

**Superseded Document(s):** 2409.11,10 (Amendment 2409.11a-91-1, May 22, 1991

**Digest:** Following is an explanation of the changes throughout the directive by section.

**10:** Throughout chapter 10, makes minor editorial corrections in spelling, punctuation, and style practices and updates cross-references to directives. Substantive changes are as follows:

**11:** Adds the definition of a "Cubic Foot Unit."

**11.4:** Adds a reference to contract scaling organizations.

**14:** Replaces the former reference to portable field computer and data recorder with field data recorder. In exhibit 01, adds an example of a log scale sheet that was previously in chapter 60, Appendixes.

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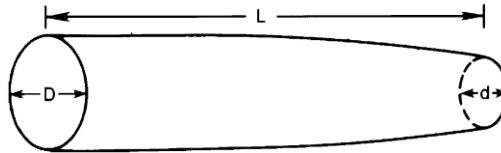
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## 11 - Scaling Forest Products

This Handbook provides a uniform national system for scaling forest products manufactured from trees and for determining their volume in cubic feet. The dimensions of a cubic foot unit are 12 inches wide by 12 inches high by 12 inches long. Scaling determines the quantity of forest products such as logs, poles, piling, and small roundwood in customary commercial measurement units such as cubic foot volume, linear feet, number of pieces, and stacked solid cubic foot volume. Regardless of the commercial measurement unit used, the cubic foot volume of the wood is always determined for use in various forest management systems.

### 11.1 - Smalian Formula

Forest Service scalers shall use the Smalian formula as a standard for determining cubic volume.



**Frustrum of a Paraboloid**

$$V = \frac{(A + B)}{2} \times L$$

$$V = \frac{\frac{3.1416 D^2}{4 \times 144} + \frac{3.1416 d^2}{4 \times 144}}{2} \times L$$

$$V = 0.002727 (D^2 + d^2) L$$

Where:

- V = Volume in cubic feet (ft<sup>3</sup>)
- A = Large end cross-section area (ft<sup>2</sup>)
- B = Small end cross-section area (ft<sup>2</sup>)
- D = Large end diameter (inches)
- d = Small end diameter (inches)
- L = Length (feet)

## **11.2 - Determining Product Quantity**

Scaling determines the quantity of forest products, and grading determines the quality. Do not consider log grade or potential lumber or veneer quality when scaling saw or veneer logs.

## **11.3 - Species Identification**

Since logs of different species often differ in stumpage rates and scaling specifications, the scaler's ability to identify logs by species is extremely important. Determine species by features such as bark characteristics, color and smell of the wood, amount of sapwood and heartwood, and presence of pitch (sec. 04.2).

## **11.4 - Scaler Information Form**

Forest Service timber sale contracts specify estimated quantities, prices, and product or piece specifications. Minimum product and piece specifications in Forest Service timber sale contracts are stated on the scaler information form.

Each Region shall provide a standard form for informing scalers of contract scaling requirements, sampling information, applicable FSH 2409.11a supplements, and any other pertinent scaling information (sec. 04.3).

The Contracting Officer must complete these forms for the timber sale and ensure the distribution to scalers; and also distribute the forms to check scalers, purchasers, contract scaling organizations, and third-party scaling organizations, when necessary prior to hauling. Scalers shall have these forms available for reference at the scaling site (sec. 04.4 and 04.6).

## **12 - Scaler Qualifications and Proficiency Requirements**

On scaled sales, the scaler determines the volume of products removed from the sale areas. The scaler must be trained, certified (FSM 2443.21; FSH 2409.15, sec. 24), and equipped with good tools to accurately determine volumes for payment.

Determine a scaler's accuracy by check scales. Scaling standards are listed in FSH 2409.15, section 24. Any check scale showing unsatisfactory scaling by a scaler indicates the need for corrective action (FSH 2409.15, sec. 24.3).

### **12.1 - Mill Visits To Develop Skills in Defect Deductions**

A proficient scaler must know how defects extend into logs and must keep that knowledge current. The best way to acquire skill and judgment in making defect deductions is to see defective logs opened in the mill and note the losses caused by various defects.

The following guidelines for mill visits can make the scaler's visits more effective and efficient:

1. Schedule time on a regular basis to observe logs being processed.
2. Choose periods when the species and the desired defect is being cut.
3. Request permission to select logs with a variety of defects.
4. Scale, mark, and diagram selected logs prior to a mill visit.
5. Observe cutting and give particular attention to the extent of defect by comparing the estimate of defect penetration with what actually occurs in the log.
6. Where possible, follow boards from some logs through the edger and trimmer to the green chain. Observe any volume loss due to defect that may occur at these points.
7. Visit the planer to observe the final stage in lumber production.

## **12.2 - Log Yard Visits To Develop Skills in Defect Deductions**

With purchaser agreement, the scaler has the option to view rebucked logs in the log yard to develop skill and judgment in defect deductions.

## **12.3 - Team Scaling**

Team scaling occurs when two or more scalers work together on the same log(s). Team scaling may be permitted only in special situations and only with prior approval of the Regional Forester (sec. 04.2).

# **13 - Safety, Efficiency and Equipment**

## **13.1 - Safety**

The various hazards present in all types of scaling require the scaler to be safety conscious at all times. FSH 6709.11, Health and Safety Code Handbook, provides information on good safety practices to follow in all types of scaling. Each scaler should have a copy of that Handbook at the scaling site.

Follow the safety rules of the Health and Safety Code Handbook, as well as applicable Occupational Safety and Health Administration (OSHA) standards, and comply with additional specific safety requirements designed for each individual scaling location by the Forest Supervisor (sec. 04.3).

## **13.2 - Efficiency**

Practice efficiency in scaling. Losses from poor scaling caused by inadequate tools, platforms, training, or log presentation can quickly exceed apparent savings. Special requirements are covered by the sale contract. Methods of scaling should consider safety, efficiency of scaling,

provisions for check scales, and the operating needs of the purchaser (FSH 2409.15, sec. 22). The scaler shall inform the Contracting Officer when logs cannot be scaled efficiently and accurately.

### 13.3 - Scaling Equipment

Scalers must keep all scaling equipment serviceable and safe to use (sec. 04.5).

#### 13.31 - Tools for Measuring Diameters

Use scale sticks or measuring tapes for measuring diameters at log ends. Use calipers or other appropriate tools for measuring intermediate log diameters.

#### 13.32 - Tools for Measuring Lengths

Use retractable measuring tapes, graduated in feet and tenths of feet, for measuring log lengths. Also use tapes to measure dimensions of stacked wood.

#### 13.33 - Tools for Determining Defect

Use a spudding hatchet or similar tool for locating defects in the ends and sides of logs. Its use is essential on logs with ends that are muddy, dusty, caked over, casehardened from exposure to the hot sun, or discolored, and for locating rotten knots, conks, and other exterior defects. An ax or hatchet may be substituted in some areas. A chain saw is a useful tool where permissible. Water can be a valuable tool in helping identify a defect such as red ray rot in ponderosa pine.

### 14 - Recording Log Scale Data, Recording Tools, and Scale Sheets

Use approved scale sheets or field data recorders to record log scale data. The minimum data include:

<u>HEADER</u>	<u>LOG DATA</u>
Sale Name	Log Number
Contract Number	Species
Date Scaled	Length
Receipt Number	Diameters
Scaler I.D.	Defect
Scaling Location	
Stratum I.D. (Sample Scale)	

Make corrections on the paper copy by drawing a single line through the incorrect entry and writing the correct figure beside it.

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Regional Office Forest Management staff must verify that field data recorder programs identify changes or corrections to the original scale data after the load has been scaled and closed out on the field data recorder.

Exhibit 01 displays an example of a log scale sheet.

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**14 - Exhibit 01**

**Example of Log Scale Sheet**

Cubic Scale Sheet																											
Ticket No.						Sale Name						Scale Location						Remote (Y/N)		Region		Forest		District		Date	
Contract No.						Log Brand						Merch Factor						Check Scaler		Scaler		Net Weight		Haul Date		Time	
Gross Log Data						Deductions																				Total	
						Seg. 1							Seg. 2							Seg. 3							
#	Sp	Ln	D1	D2	B	% D	D	Sq. Area	% L	L	P/R	% D	D	Sq. Area	% L	L	P/R	% D	D	Sq. Area	% L	L	P/R	G	N		



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**14 - Exhibit 01--Continued**

Cubic Scale Sheet																											
Ticket No.						Sale Name						Scale Location						Remote (Y/N)		Region		Forest		District		Date	
Contract No.						Log Brand						Merch Factor						Check Scaler		Scaler		Net Weight		Haul Date		Time	
Gross Log Data						Deductions																				Total	
						Seg. 1							Seg. 2							Seg. 3							
#	Sp	Ln	D1	D2	B	% D	D	Sq. Area	% L	L	P/R	% D	D	Sq. Area	% L	L	P/R	% D	D	Sq. Area	% L	L	P/R	G	N		

B = Butt indicator, P = Product indicator, R = Ring Deduction method, L = Length Cut or length of defect