

# Introduction to Cubic Scaling

# Why We Scale

- Primary Reason?
- Establish Log Value
- Basis for Payment



# Why We Scale

- **Secondary Reason?**
- **Predict quantity of end-products**



# Scribner Rule Design



**Diagram scale rule**

**Board foot**  
**12" x 1" x 1'**



# Scribner Rule Design



**Any load of logs**

**Board foot volume  
1" thick boards**



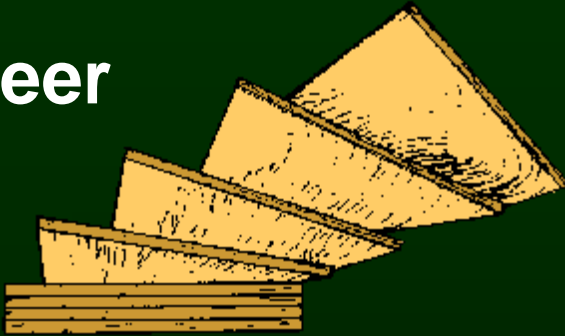
# Lumber End-products

- **Not always one-inch thick**
- **Include many sizes**
  - **Boards**
  - **Dimension**
  - **Beams**

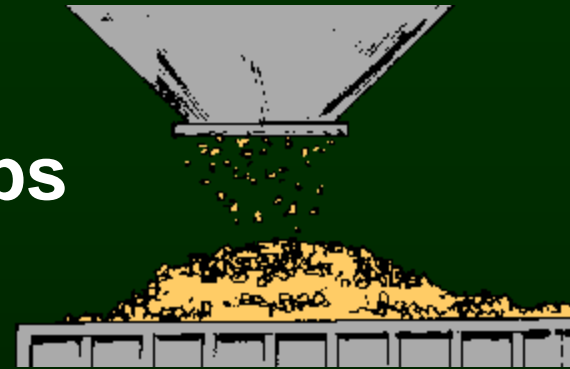


# Other End-products

**Veneer**



**Chips**



**Sawdust**



# Cubic Rule Design

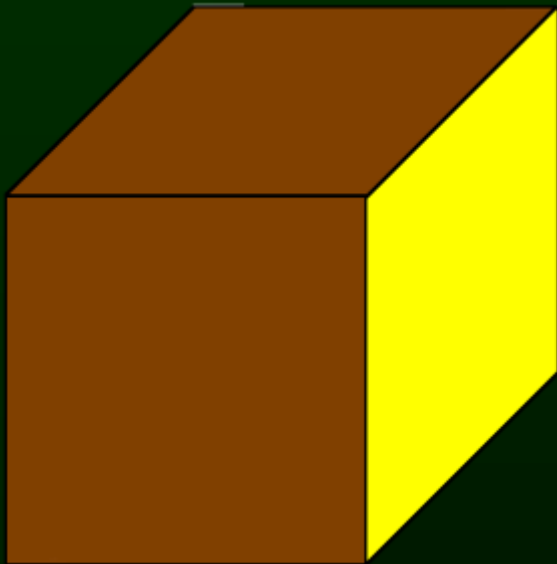
- **Formula scale rule**
- **Based on geometric shape**





# Cubic Rule Design

Based on cubic foot - 12" x 12" x 12"



Cubic foot

vs.

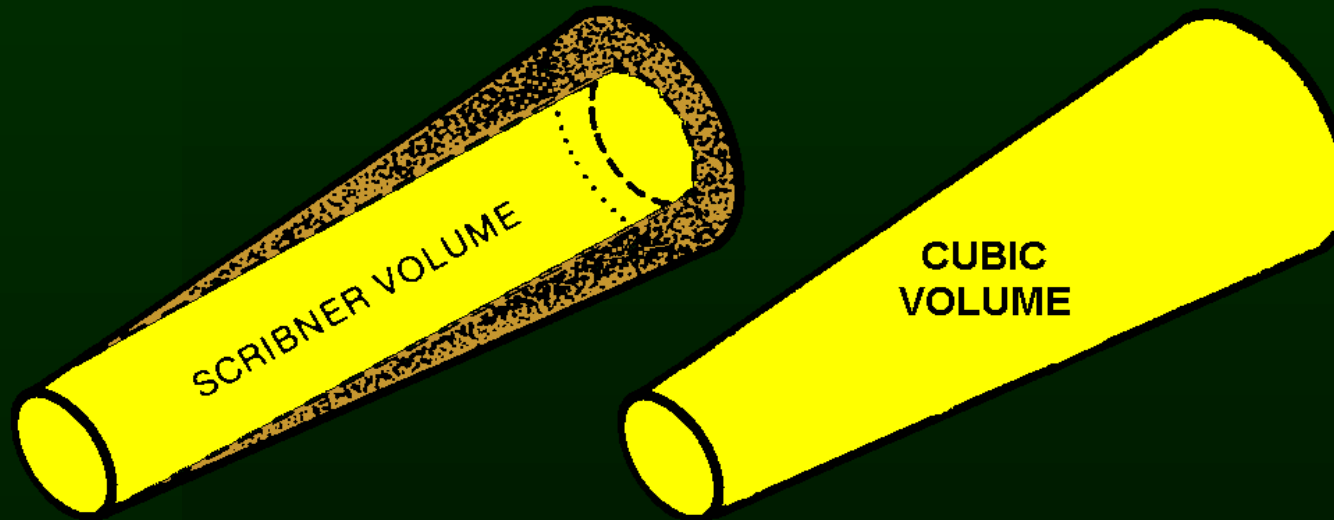
Board Foot



# Cubic Rule Design

**Scribner disregards taper**

**Cubic includes log taper**



# Cubic Foot Log Scaling



- How gross scale is determined
- What defects are deducted
- Converting from board feet to cubic feet

# Cubic Log Scaling Training

United States  
Department of  
Agriculture  
Forest Service



# National Cubic Foot Log Scaling Handbook

**FSH 2409.11a**

## National Forest Cubic Scaling Handbook



United States  
Department of  
Agriculture

Forest  
Service



# Gross Scale Measurements

- **Scaling Lengths**
- **Scaling Diameters**

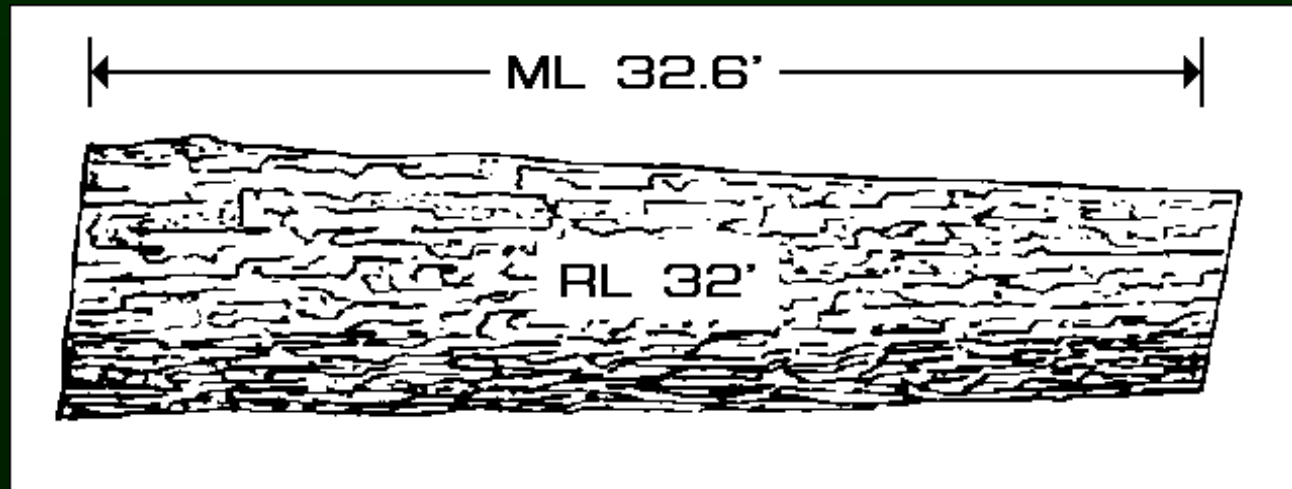


# Determining Scaling Length

- **Measure log length to 0.1 foot**
- **Maximum trim per segment - 0.5 foot**
- **Maximum segment length - 20 feet**
- **Record log scaling length in feet**
- **Record the scaling length of logs overrunning the maximum allowable trim to the next 1-ft length**

# Measuring Log Lengths

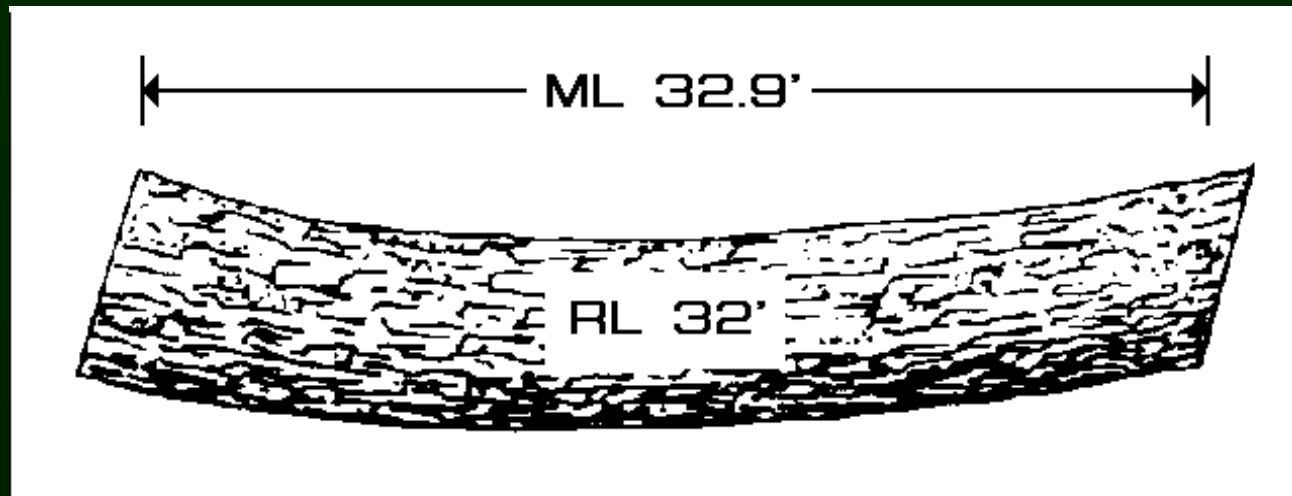
- Disregard bias-cuts when measuring length to 0.1 foot





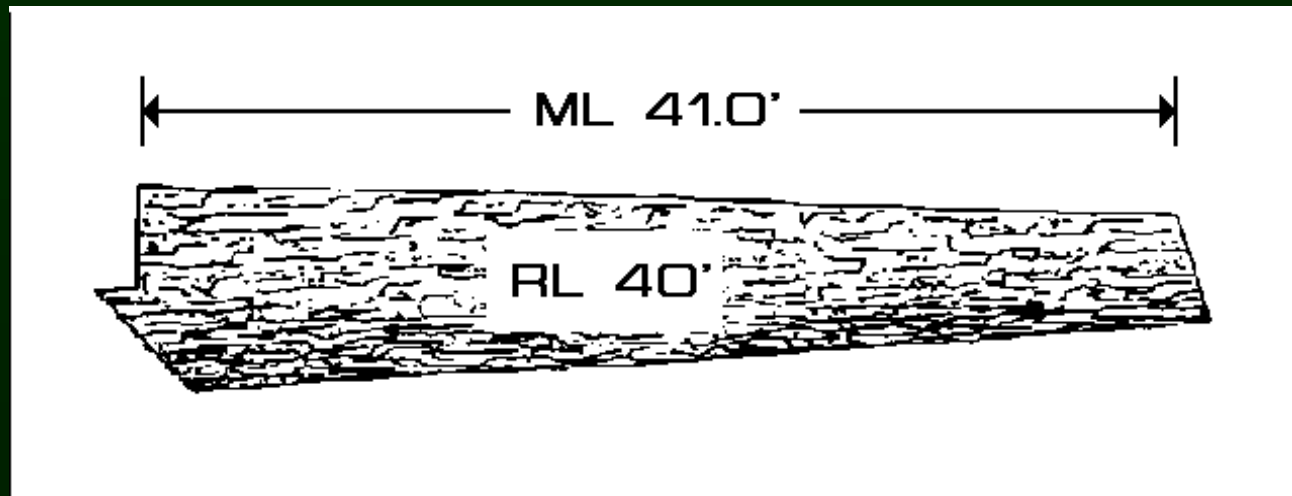
# Measuring Log Lengths

- Measure to the shortest distance between applicable points at the log ends.  
(Measure short side to short side)



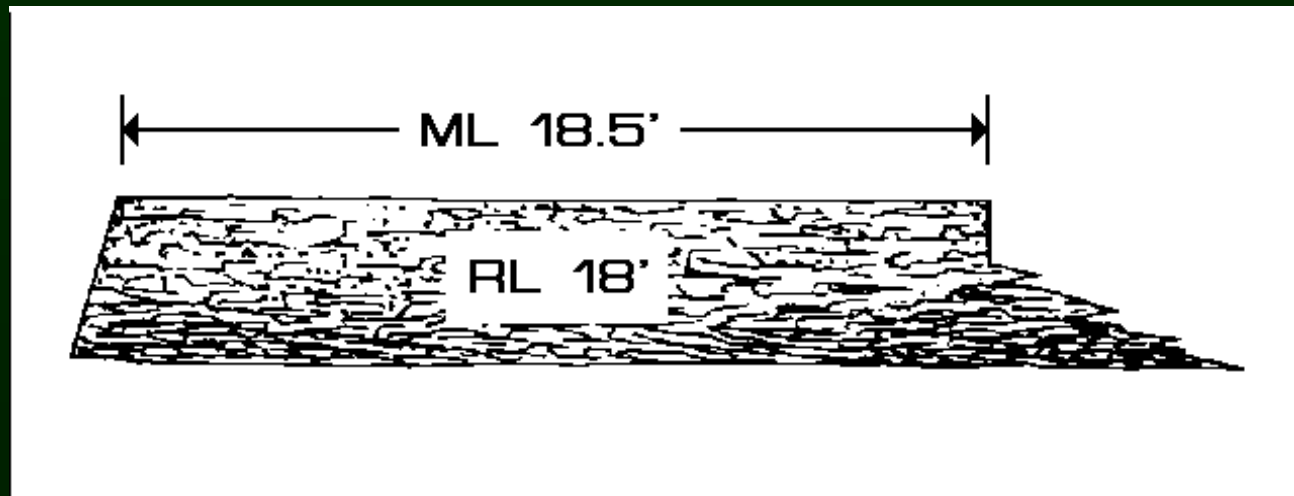
# Measuring Log Lengths

- Disregard undercuts in measuring lengths of butt logs



# Measuring Log Lengths

- Measure length on partially bucked logs from saw cut to saw cut



# Measuring Log Diameters

**A diameter is required at each log end**



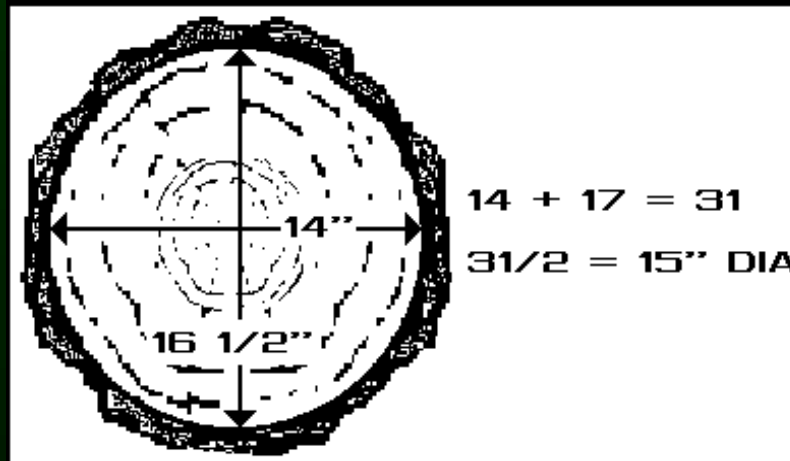
# Measuring Log Diameters

- Measure inside bark
- First measure the narrow-way
- Make another measure at a right-angle



# Measuring Log Diameters

- Average the right-angle measurements
- This is the scaling diameter



# Determining Butt Diameter

- **Narrow way and right-angle**
- **Allow for bark thickness**
- **Average the measurements**
- **This is the scaling diameter**



# Determining Gross Cubic Foot Volume of Logs

- **The Smalian formula is used to calculate log volume**
- **Volume is calculated & recorded to one-tenth (0.1) cubic feet**



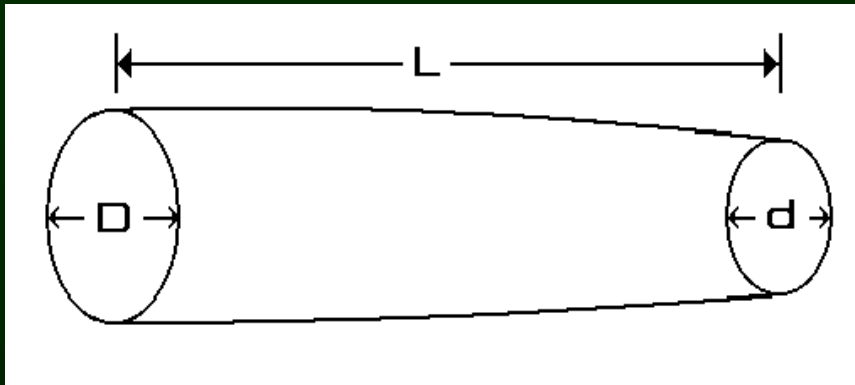


# Determining Gross Cubic Foot Volume of Logs

- **Calculations ending in 0.05 cubic feet or more are rounded to the next tenth (0.1) cubic foot**
- **For multi-segment logs, the volume of each segment is calculated and the segment volumes are added to determine the total log volume**

# Smalian Formula

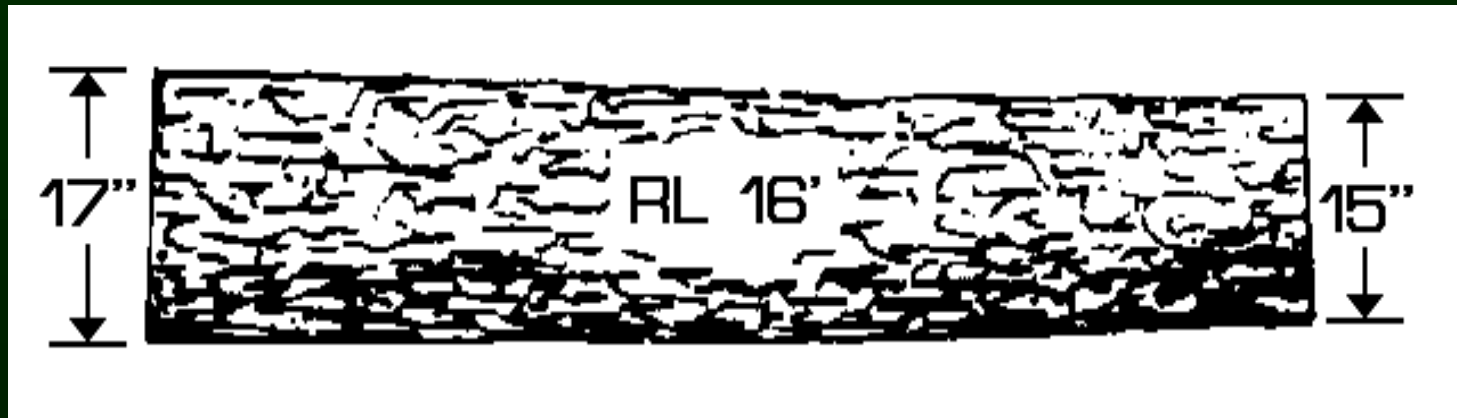
$$V = 0.002727 \times (D^2 + d^2) \times L$$



- **V = Volume in cubic feet (ft<sup>3</sup>)**
- **D = Large diameter**
- **d = small diameter**
- **L = segment length**

# Volume for One Segment Log

- Scaling length
- Scaling diameters



# Volume by Formula Calculation

$$\begin{aligned}\text{Volume (ft}^3\text{)} &= 0.002727 \times (D^2 + d^2) \times SL \\ &= 0.002727 \times (17^2 + 15^2) \times 16 \\ &= 0.002727 \times (289 + 226) \times 16 \\ &= 0.002727 \times 514 \times 16 \\ &= 22.4\end{aligned}$$



# Volume by Look-up Table

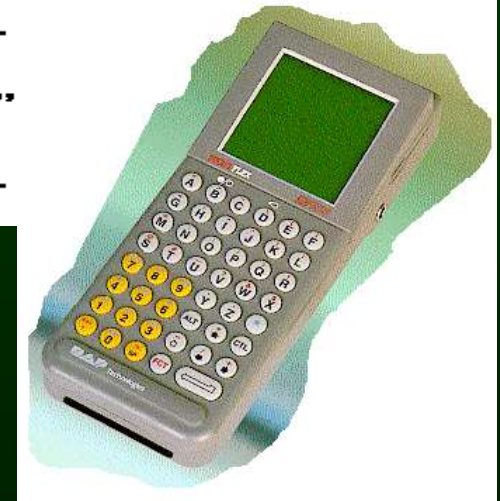
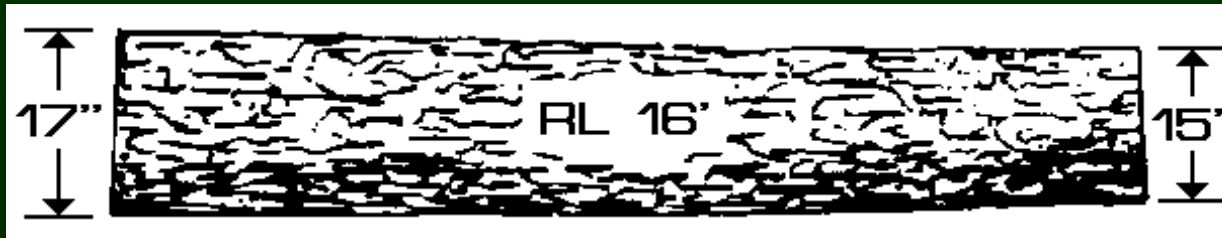
Cubic Foot Log Volumes Segment Length = 16 ft.

Small End Volume (ft<sup>3</sup>) = .002727 (D<sup>2</sup> + d<sup>2</sup>) SL

Small End Dia.	INCHES OF TAPER							
	0	1	2	3	4	5	6	7
14	17.1	18.4	19.7	21.2	22.7	24.3	26.0	27.8
15	19.6	21.0	22.4	24.0	25.6	27.3	29.1	30.9
16	22.3	23.8	25.3	26.9	28.6	30.4	32.3	34.3
17	25.2	26.7	28.4	30.1	31.9	33.7	35.7	37.7
18	28.3	29.9	31.6	33.4	35.3	37.2	39.3	41.4



# Volume by Handheld Recorder



- Scaler enters log length
- Scaler enters log diameters
- Handheld calculates volume

**22.4 cubic feet**

# Sources of Cubic Scale Defects

- **Natural**



- **Logging**



# Cubic Scale Defects

- Unsound wood
- Abnormal shape
- Won't make lumber or veneer





# Basic Defect Deduction Rules

- **These rules apply to sawlogs and veneer (peeler) logs**
- **Assess defect length to allow lumber recovery in 2-foot multiples**
- **Minimum board size 1"x4"x6'**



# Basic Defect Deduction Rules

- More than one defect method may be used in scaling a log
- Consider defect shape (cylinder, cone) when estimating defect length
- Stain by itself is not a defect



# Basic Defect Deduction Rules

- Calculate and record volume to the nearest 0.1 cubic foot
- Minimum recordable volume for any single defect is 0.2 cubic foot
- Deduct for defects on log ends (such as stump pull) only to the extent that the defect exceeds 0.3 foot in length

# Defect Deduction Methods

## **Cubic**

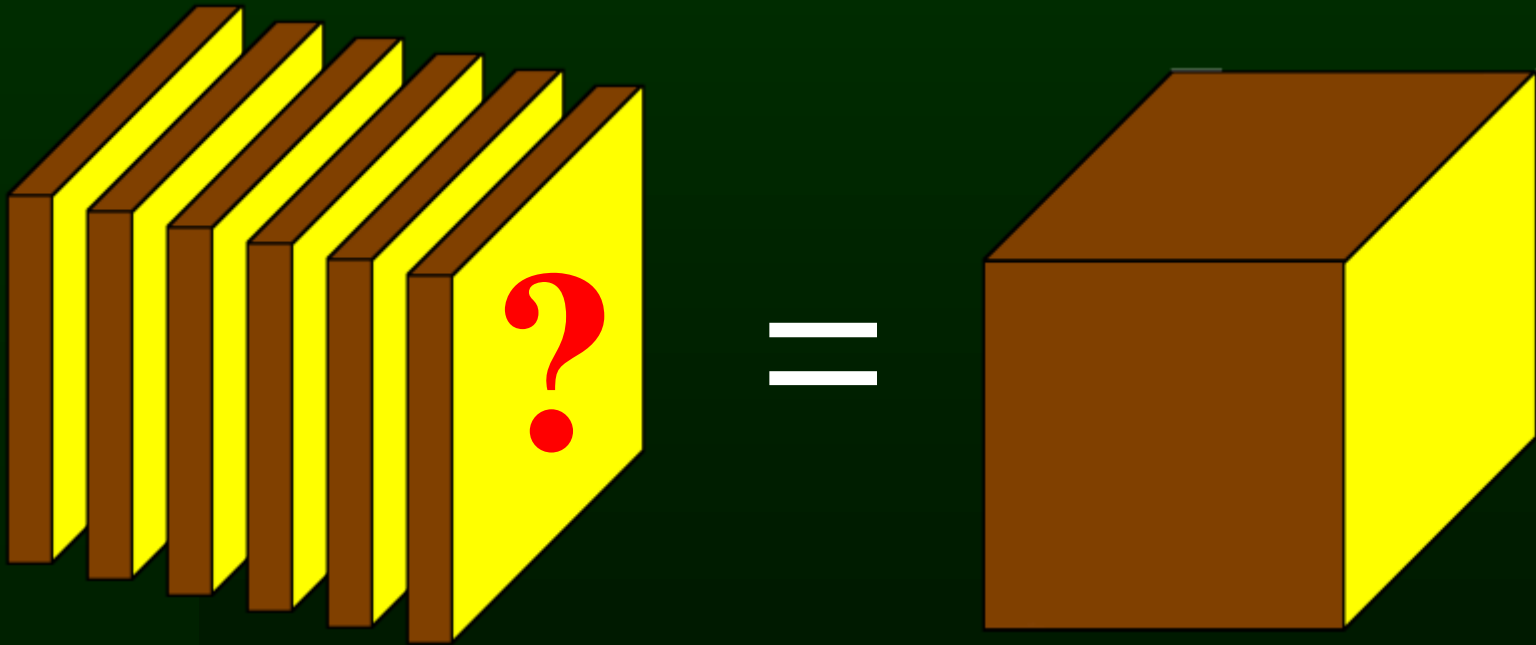
*and*

## **Scribner**

- Squared Area
  - Length Deduction
  - Percent Deduction
  - Diameter Deduction
  - Ring Deduction
- Squared defect cut
  - Length cut
  - Pie cut
  - Diameter cut
  - Squared defect cut
    - replace sound core

# Converting Board Feet to Cubic Feet

- How many board feet in a cubic foot?



# Computing Board Foot/Cubic Foot Ratios



- Scaling length 20'
- Scaling diameters 12" & 15"
- Defect 5' length or 1/4 of the log

- **Board feet**

gross = 100 BF

net = 70 BF

- **Cubic feet**

gross = 20.2 CF

net = 15.1 CF

- **Net BF/CF ratio**

$70 \div 15.1 = 4.64$

# Board Foot / Cubic Foot Ratios

- **No hard and fast conversion factor**
- **References commonly cite “6” BF/CF**
- **Vary with log size, taper, and length**
- **General guidelines**
  - smaller logs - lower BF/CF ratio**
  - greater taper - lower BF/CF ratio**
  - lengths - variable BF/CF ratio in small logs**

# Cubic Scale - When?

- **Not yet common in our area**
- **USFS is currently using**
- **Offers advantages over Scribner**
- **Reluctance to adopt cubic measurement unit**
- ***... Maybe in the near future?***