How Can We Measure Trees and Logs for more Useful Information

For: Timber Measurement Society
Coeur D'Alene, Idaho
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Atterbury Consultants, Inc.
Forestry Consultants

- Offices in Oregon and Washington
- Timber Cruising, Forest Inventory, Supply Studies, Appraisals
- GIS mapping and Ownership Maps
- Forestry Equipment Sales
  - Online shopping
  - Software, maps, handhelds, GPS
- Software
  - SuperACE, Pocket SuperEasy

Toby Atterbury

- BS in Forestry, University of Washington
- 25 years in Corporate Forestry
- 25 years plus in Consulting Forestry
- Gold member Society of American Foresters
- Lifetime achievement Award, U of W Forestry Alumni Association

Introductory Comments

- Pleasure to be in this beautiful part of the world with you fine people.
- Thank you all for coming and the for invitation to speak to you this morning.
- I have worked in all of the timber regions of the USA and several other countries.
- Thus I have used many different log rules for both board feet and cubic feet. Confusing but fun.
- I have had the privilege of working in this industry for over 50 years. I love the forest.
- The last few years our country and industry have been in a recession. The view of many in the industry are that the costs of **forest inventory and log scaling are too high.**
- This assignment has caused me to pause and look at how we got to this point in the measurements of our forests and the products from those forests. The research for this talk was fun.
- I realized how much we have changed some things and how little other things.

Outline

- Forest Inventory
- Scaling
- Board foot rules
  - Scribner
  - Others
- Cubic foot rules
  - Actually measures the volume in a tree or log
  - Many formula available
- Weight
  - Smaller trees more weight used
- Other measures
  - Lineal feet – poles & piling
  - Cords - firewood
  - Carbon – to save the earth
  - Biomass for energy
- How should we measure the forest and the wood produced from it to plan, do business with the rest of the world, report the results to the public

Questions Foresters are Asked

- How much can we harvest from the forest and maintain value?
- Where should we harvest next year and over the next rotation?
- How much should we bid on that timber sale or tract of forestland?
- Should we increase the capacity of the sawmill or pulp mill?
- Where can we build a 40 MW power plant using waste (or Free) wood, Biomass, Hog Fuel?
- What is the conversion factor from board feet to tons?
- How many cubic meters of wood can we deliver to the port docks next year?
- How much “Down and Woody” per acre in cubic feet?
- Should we plan on the National Forest for logs in the next decade?
- How much carbon is being stored in the Forest? How much if we change rotation length?

Why We Measure Timber and Logs

- Timber and Timberland
  - Sell, buy, and trade timberlands
  - Set harvest rates and timing
  - Determine budgets for forest activities:
    - Silvicultural activities
    - Road building and maintenance
    - Staffing
- Logs – Determine the grades, volume, and the **$ value** of logs being sold to mills or exporters.

Today's Situation in the USA

- The United States is now the only nation in the world that uses English Measurements and various board foot log scales. The rest of the world uses metric measurements and cubic.
- Wood is used for many products and logs are measured and sold by board feet, cubic feet, lineal feet, tons, and cords.
- Scale measurements and reporting units vary by region, mill, organization and ownership.
- The trees we harvest are getting smaller every year.
- Contrary to popular belief, there is no conversion factor from board feet to anything else.
- Public forests are not producing many logs these days.

How are Volumes Measured?

- Standing Timber - Forest Inventory, Cruising
  - Area: GIS maps, images
  - Volume, Quality:
    - Statistical samples
    - Small samples, usually less than 2% of trees
    - Reports in Board feet, cubic feet, and tons, number of logs, trees per acre, basal area per acre by species
- Logs
  - Scaling
    - Board feet, lineal feet, cubic feet, cords, log count by species and grade
  - Weight
    - Tons
  - Test scaling, board feet, cubic feet, and weight

Log and Wood Measurements and Reporting Units – Confusing!

- No standards for measuring and reporting wood volumes in the USA or the World.
- Measurements of forests and logs around the world is done in a variety of ways.
- Units of measure can be English or metric to the nearest unit, tenth, or fraction dropped.
- Logs diameters can be measured at one end, both ends, in the middle, inside bark, outside bark, one bark, or two barks.
- Reporting units can be board feet of logs, board feet of lumber, cubic feet, cubic meters, lineal feet, and tons.
- Weight can be in tons (short, long, and metric), wet or bone dry.
- Board and cubic foot volume tables and formula yield different answers for the same measurements.

Trees and Forests

- **Trees**
  - Many species
  - Vary in:
    - Size, productivity
    - Value to man and animals
  - All have a common shape
    - Lower stem concave
    - Upper stem is convex
  - Are useful to man in many ways
    - Firewood and fuel
    - Lumber, plywood,
    - Poles, piling
    - Paper and cardboard
    - 100s of others including aspirin, tooth paste, rayon

- **Forests**
  - cover one third of USA
- Vary in:
  - Ownership
  - Species content
  - Age
  - Productivity, Growth rate
  - Tree sizes
  - Topography & Climate
  - Access & political status
- Renewable and Sustainable
- Carbon neutral

Changes over Time

- Until the early 1960s all cruise, inventory, and scale data had to be calculated by hand.
- Thus we had tables or vary simple formulas to calculate volumes.
- During the 1960s mainframe computers with batch processing began to automate the process and we put these tables in computers.
- The 1980s brought desktop and handheld computers.
- We then could use the basic formulas used to construct the tables.
- Trees could be cruised as they will be made into logs and volumes calculated as they will be scaled.
- Data could be checked in the field with handhelds, which brought us better data.
- The forester collecting the data could now process cruise data into useful reports with the desktop (PC) computer.
- Reports include various board foot volumes, cubic, tons, carbon, and biomass.
- The questions we are being asked have also changed.

Forest Inventory

- Forest inventory is used for:
  - Operational Planning
    - Reforestation, fertilization, pre-commercial thinning, commercial thinning, and clear cuts.
    - Road building and maintenance
    - Stream buffers and Threatened and Endangered species
    - Staffing and budgeting
  - Strategic Planning
    - Harvest levels
    - Buy, sell, trade timberlands and processing facilities
    - Appraisal for borrowing money for operating and purchases
    - Expanding or contracting processing facilities, including biomass processing

Forest Inventory

- Maintaining Geographic Information System (GIS) data base with many layers of data to produce maps and acreage data.
- Sample the stands with plots, usually measuring less than one percent of the trees.
- Volumes can be calculated and reported in board feet, cubic feet, or weight.
- Build data bases capable of maintaining the data, growing the data over time, and reporting the information in various formats.
- Maintaining the accuracy of the data by:
  – Sampling 10% of the forest each year
  – Comparing the harvest volumes to the scale data each year and keep a running total by species, grades, sorts
  – Making the needed changes for land sales and acquisitions, harvesting, reforesting, PCT, other activities each year.

Forest Inventory Reporting

- GIS; Acreages, maps, maps of plans, tracking intensive forest management investments,
- Forest Inventory data
  - Species, trees per acre, basal area per acre
  - Volume units; Board feet, cubic feet, lineal feet, tons
  - Biomass in cubic feet, tons
  - carbon

SuperACE – ACI Cruise Program

- Tree measurements
  - Species, DBH, FP, FF (FQ), TD, Bole Ht., Total Ht.
  - Variable log lengths, Sorts, Grades, Defect deductions
- Diameters along the bole are calculated for the butt and top of each log (variable log lengths).
- Various scaling rules are applied to each log to compute the needed volumes in board feet, cubic feet, or tons.
- Defects by log in feet and inches or percents
- Many different reports

SuperACE – ACI Cruise Program

- Board Foot Scaling Rules -14
  - Westside, 1 in 10, Eastside, Omak, Gilchrist,
  - Idaho, Targee, Salmon River, California, Southern
  - Doyle, Doyle with length minimum
  - International, BIA
- Cubic Scaling Rules - 6
  - Smalian, Northwest, National
  - Weyco, S Weyco, Newton
- The program can calculate and report volumes computed by various log rules for comparisons and conversion factors.

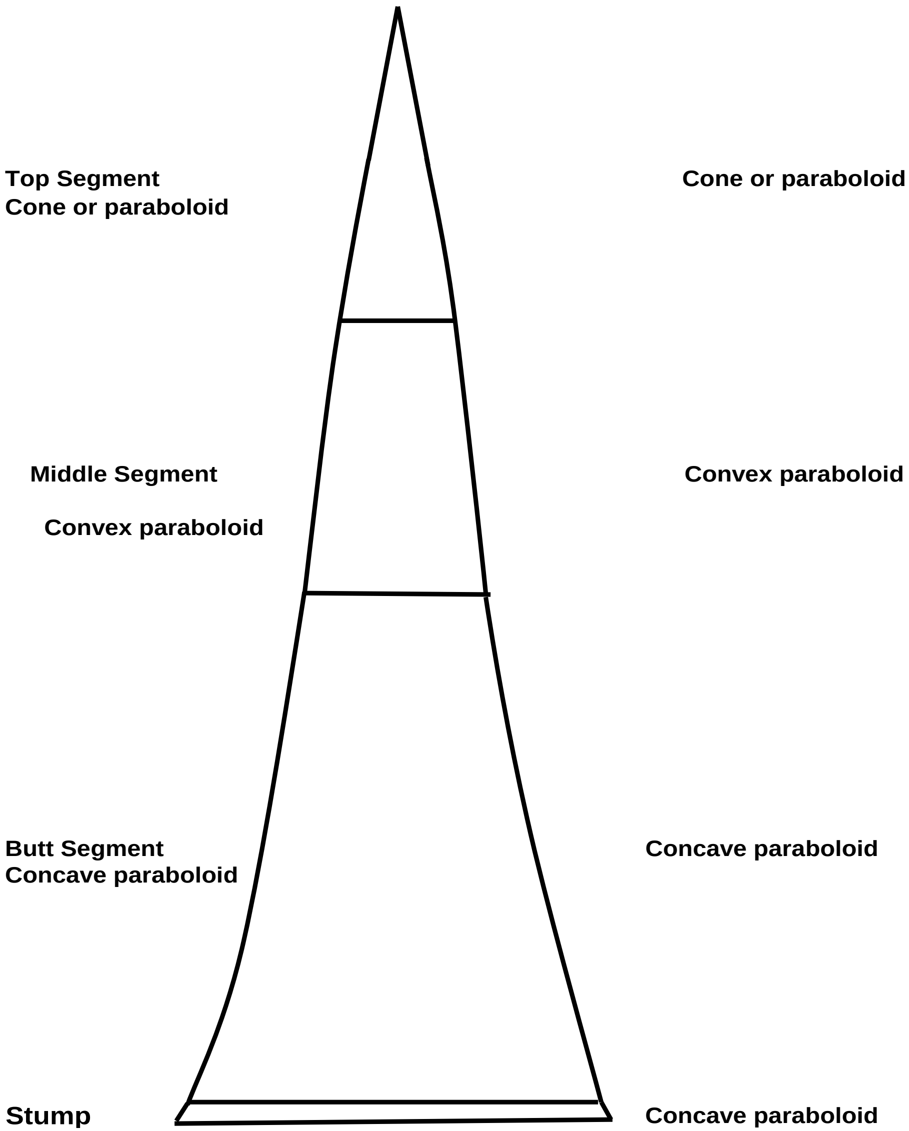
Plot and Tree Measurement Tools

- Top to Bottom
  - Criterion RD 1000
    - BAF, Dendrometer
    - Diameters along the bole
  - GPS – Holux
    - location,
    - navigation,
    - area
  - Handheld – waterproof, rugged
    - enter, store, and calc data
    - Maps, images, GPS locations
  - Laser
    - Distances
    - Tree Heights
    - Plot sizes
  - Also: Increment borers, compasses, bark gauges, others

Trees

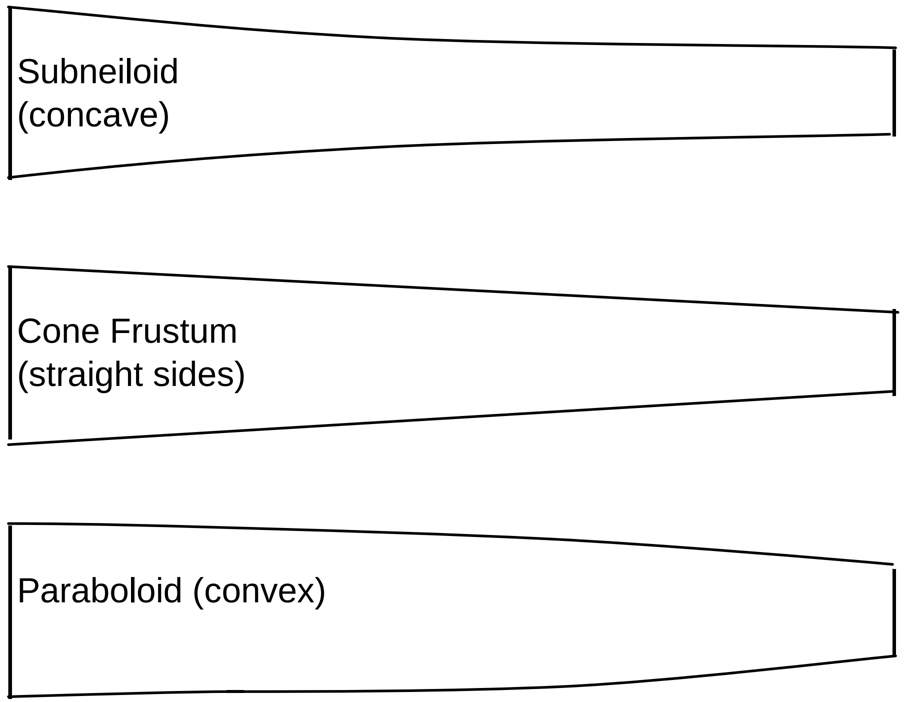
- Trees are not the shape of cylinders
- They change geometric shape from stump to tip
- They are not perfectly round
- Logs cut from trees vary in shape

The Shape of Trees



Shapes of Logs

Cone Frustum is the form of Smalian and NW Cubic Rules



Butt logs

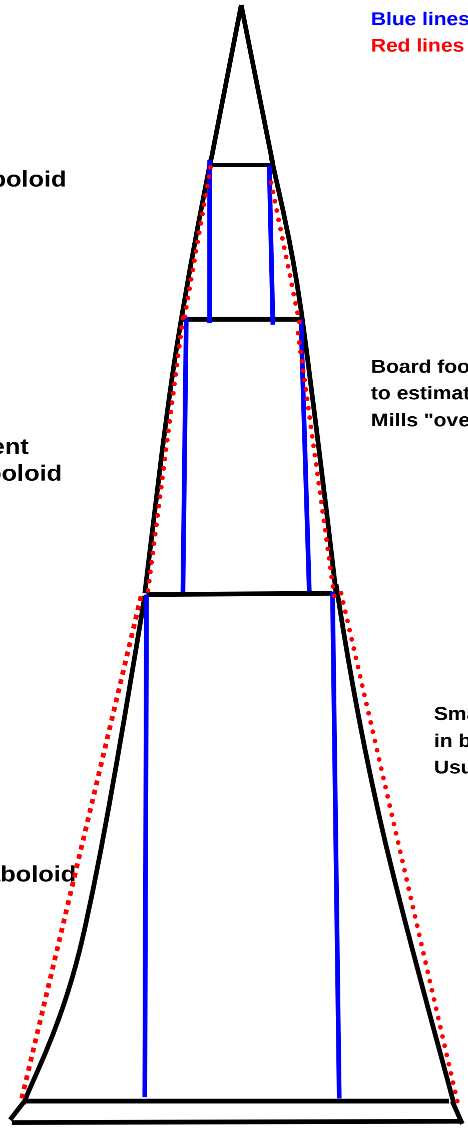
Middle and or top logs

Middle and or top logs

Tree Shape - Log Measurements

Blue lines - board foot scaling cylinder
Red lines - Smalian

Top Segment
Cone or paraboloid



Board foot scaling rules use a cylinder to estimate the products produced. Mills "overrun" board foot log scale.

Middle Segment
Convex paraboloid

Smalian overestimates the volume in butt logs and underestimates top logs. Usually within 2% of total.

Butt Segment
Concave paraboloid

Stump

Concave paraboloid

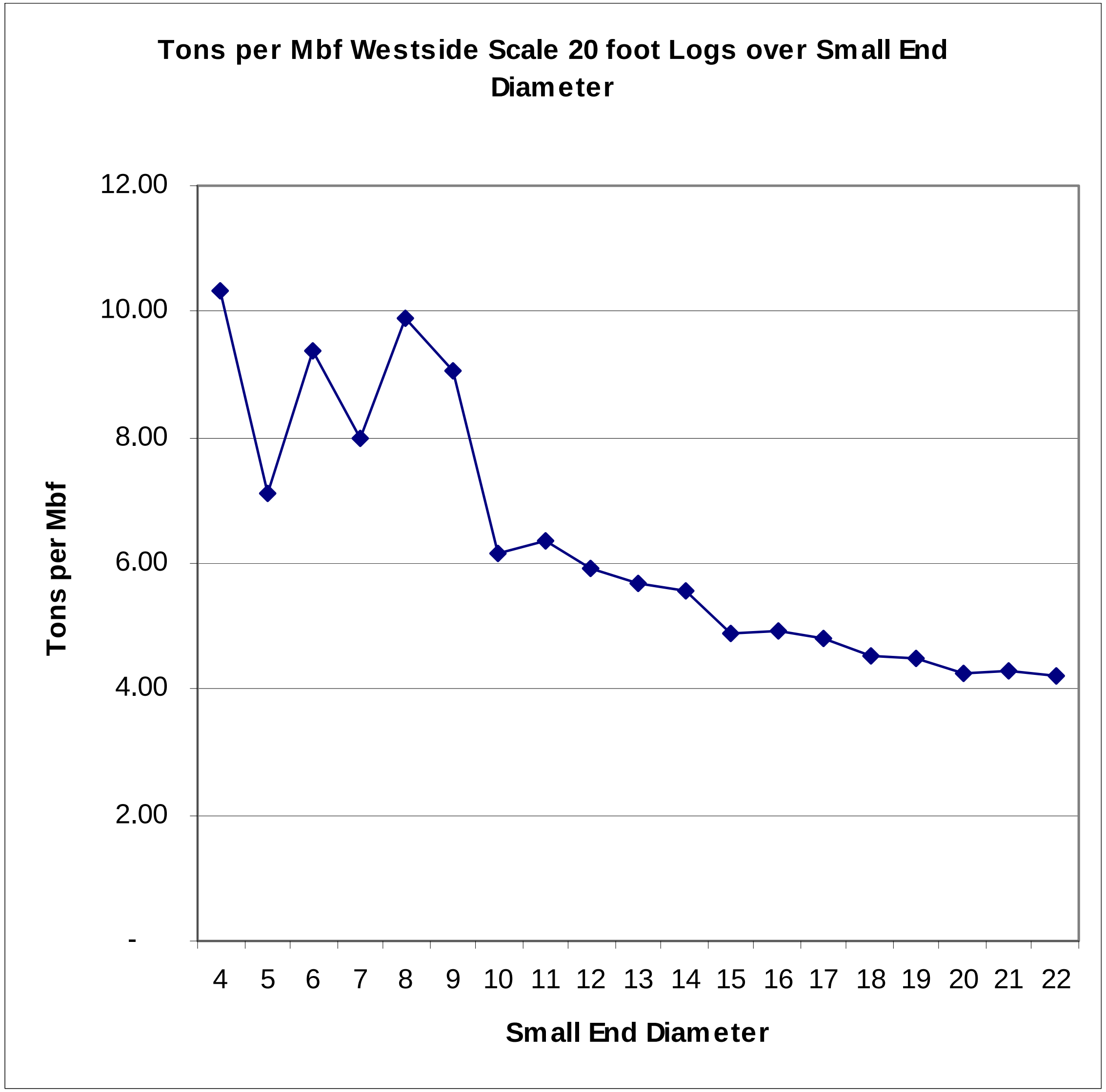
Log Scaling

- No standard scaling method in the USA
- Over 100 board foot scaling methods have been indentified in the USA – *Freese 1986*
- Scaling Practice
  - Indentify Species
  - Log measurements
  - Defect deductions
  - Grade
  - Volume calculations
- Cubic feet is not popular in the USA.
- It is accurate (if we standardized measurements) and would provide some common reporting between regions

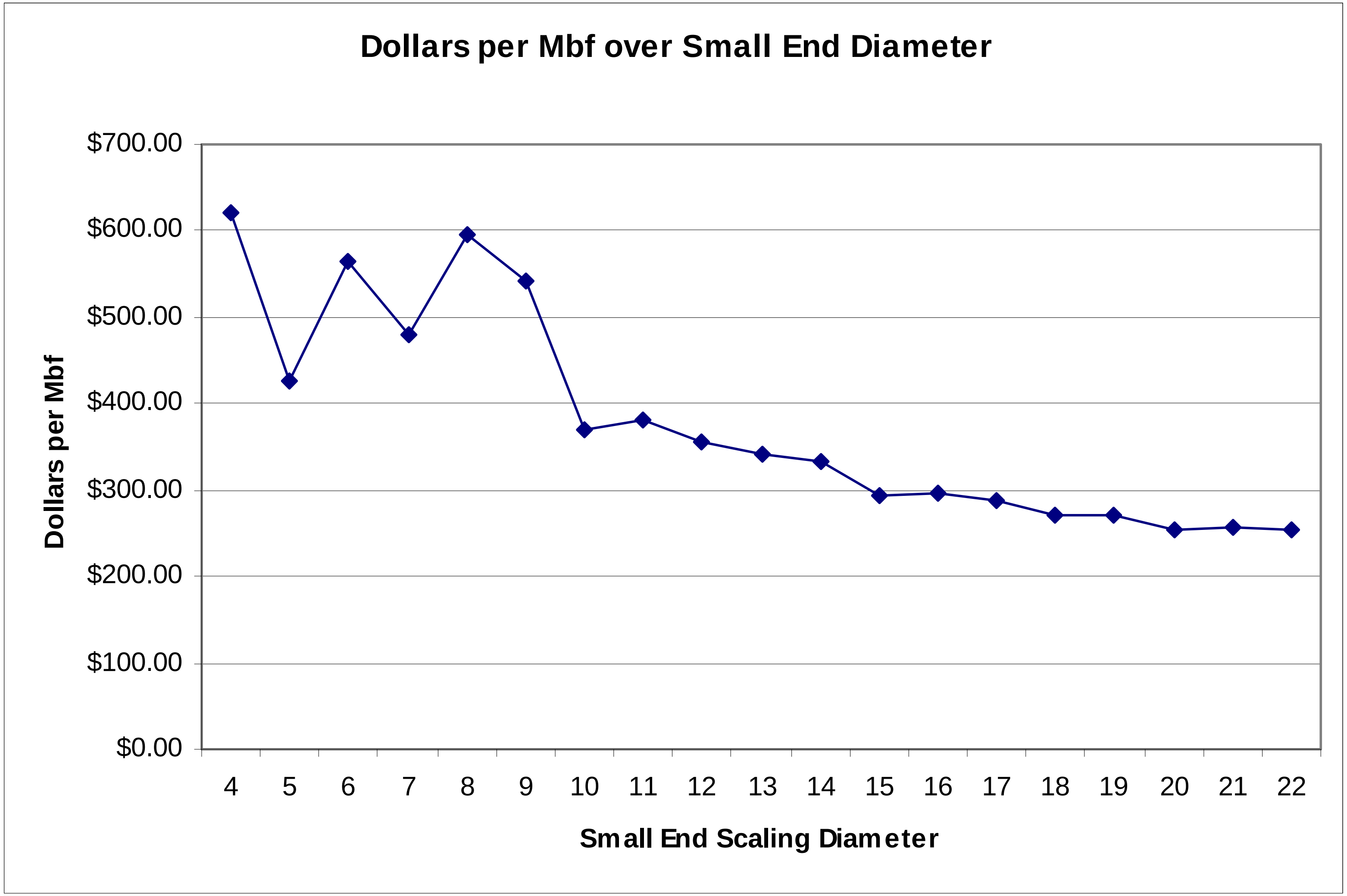
Log Scaling

- The only thing that seems to be the same across the USA is indentifying the species.
- Log Measurements can be:
  – Measuring **diameter** inside bark, including one bark, two bark, rounding to the nearest inch, dropping the fractional inch, diameter the narrow or averaging the diameters.
  – Measuring **length** including or excluding trim
    - Split length over 20 or 40 feet
    - Longest length on top or bottom
  – **Defect** deduction
    - Length and diameter deductions
    - Percent deductions
    - Board foot deductions

How should I sell my load of logs, by the ton or by scribner board feet?													
	Official Rules for the following Log Scaling and Grading Bureaus												
	West Side Rules												
	Log Length		**20**	Feet									
		Taper	**2**	inches				Fractional inches dropped					
Lbs per Cubic Foot			**55**	pounds per cubic feet green logs				**NW Rules adds 0.7 inch to diameter**					
	Taper per 10 feet		**1**	Inch									
		Trim	**1**	foot									
	Log Price per Ton		**$60.00**										
Small End Dia.	**Large End Dia.**	**Log Length feet**	**Scrib-ner bf West**	**Cubic Feet NW Rule**	**Cubic Feet per Mbf**	**bf / cf**	**Lbs. per Log**	**Tons**	**Tons per Mbf**	**Log Value (Tons * $/Ton)**	**Dollars per Mbf**	**Dollars per CCF**	
4	**6**	**20**	10	3.76	375.94	2.66	207	0.103	10.34	$6.20	$620.30	$165.00	
5	**7**	**20**	20	5.18	258.98	3.86	285	0.142	7.12	$8.55	$427.32	$165.00	
6	**8**	**20**	20	6.83	341.44	2.93	376	0.188	9.39	$11.27	$563.38	$165.00	
7	**9**	**20**	30	8.71	290.24	3.45	479	0.239	7.98	$14.37	$478.90	$165.00	
8	**10**	**20**	30	10.81	360.49	2.77	595	0.297	9.91	$17.84	$594.81	$165.00	
9	**11**	**20**	40	13.15	328.78	3.04	723	0.362	9.04	$21.70	$542.49	$165.00	
10	**12**	**20**	70	15.72	224.52	4.45	864	0.432	6.17	$25.93	$370.47	$165.00	
11	**13**	**20**	80	18.51	231.39	4.32	1,018	0.509	6.36	$30.54	$381.80	$165.00	
12	**14**	**20**	100	21.54	215.35	4.64	1,184	0.592	5.92	$35.53	$355.33	$165.00	
13	**15**	**20**	120	24.79	206.57	4.84	1,363	0.682	5.68	$40.90	$340.83	$165.00	
14	**16**	**20**	140	28.27	201.93	4.95	1,555	0.777	5.55	$46.64	$333.18	$165.00	
15	**17**	**20**	180	31.98	177.67	5.63	1,759	0.879	4.89	$52.77	$293.16	$165.00	
16	**18**	**20**	200	35.92	179.60	5.57	1,976	0.988	4.94	$59.27	$296.34	$165.00	
17	**19**	**20**	230	40.09	174.30	5.74	2,205	1.102	4.79	$66.15	$287.60	$165.00	
18	**20**	**20**	270	44.49	164.77	6.07	2,447	1.223	4.53	$73.40	$271.87	$165.00	
19	**21**	**20**	300	49.11	163.72	6.11	2,701	1.351	4.50	$81.04	$270.13	$165.00	
20	**22**	**20**	350	53.97	154.20	6.48	2,968	1.484	4.24	$89.05	$254.44	$165.00	
21	**23**	**20**	380	59.06	155.41	6.43	3,248	1.624	4.27	$97.44	$256.43	$165.00	
22	**24**	**20**	420	64.37	153.26	6.52	3,540	1.770	4.21	$106.21	$252.89	$165.00	
	19	**Logs**	**2,990**	**536.25**	**179.35**	**5.58**	**29,494**	**14.747**	**4.93**	**$884.82**	**$295.93**	**$165.00**	



Tons per Mbf Westside Scale 20 foot Logs over Small End Diameter
Tons per Mbf
12.00
10.00
8.00
6.00
4.00
2.00
-
4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Small End Diameter


Dollars per Mbf over Small End Diameter
$700.00
$600.00
$500.00
$400.00
$300.00
$200.00
$100.00
$0.00
Dollars per Mbf
4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Small End Scaling Diameter

Scribner

- Published 1846 – *Scribner's Ready Reckoner and Log Book For Ship Builders, Boat Builders, and Lumber Merchants*
- I have a 1857 copy. This was published before:
  – Electricity, computers, automobiles, airplanes, and lasers.
  – When calculations were done with paper, pencils and tables
- *Page 49 Table VI Showing the **cubical** contents of spars, and other round timber*
- *Page 53 Log Measure "To find the number of feet of Square-edged boards which a log will produce when sawed"*
- **a long time ago, in a galaxy far away**

Scribner

- 1857 Ready Reckoner
  - Log Measure - Logs Reduced to Inch Board Measure. Pages 53 to 57
  - The diameter is supposed to be taken at the small end, inside the bark, and in sections of 15 feet, and the fractions of an inch not taken into the measurement. This mode of measurement, which is customary, give the buyer the advantage of the swell of the log – the gain by sawing it into scantling, or large timber, and the fractional parts of an inch in the diameter. Still, it must be remembered, that logs are *never* straight, and that often times there are concealed defects, which must be taken as an offset for the gain above mentioned.
- *Various regions and scaling methods have certainly modified this advice.*

Excerpts from “A First Book of Forestry” - 1909

- Estimating and Measuring Timber
  - When a man buys a lot of standing timber, or when a lumberman or farmer prepares for the winter’s logging, he wishes to know **beforehand approximately how much timber he is likely to get from the tract of land he is about to cut over**. *Page 164*
  - Since estimating is always guesswork and liable to much error, it is far better to make **definite measurements wherever we can**.
  - In measuring or **“scaling” a log, it is customary, in our country, not to measure its real volume,** but to state how many feet B.M. of lumber might be cut from this log.

Scribner

- A tradition dating back to 1846.
- We are all used to using it.
- All our financial records are tied to it.
- Many still believe "overrun" is a secret. We believe in Santa.
- So, off we go into the sunset answering questions like:
  - How many pellets in a Mbf?
  - How many tons in a Mbf?
  - How many Mbf per BDUs?
  - How much biomass can we get from an area in Mbf?

The Scribner Game

- Remember, scribner does not really give real volume for logs, just a measure of lumber that would have been milled in the 1840's.
- Logger: cut shorter logs, get more board foot scale and higher handling costs.
- Mill: pay more for longer logs, fewer logs, less volume.
- Logger: buy equipment to scan trees and automatically buck to highest value?
- Cut scaling costs by paying by the ton and then converting to scribner!!!

Westside Small Log Sawmill Log Prices

ALL PRICES IN $/MBF — PRICES SUBJECT TO CHANGE WITHOUT NOTICE

PREFERRED TRIM: 14" - - - - - - - - - - - - - - - - - - - FOR 40' LOGS (All SPECIES)
12" - - - - - - - - - - - - - - - FOR 16' to 38' LOGS (All SPECIES)

DOUGLAS-FIR 5"Plus Scaling Diameter - 2Saw, 3Saw & 4Saw

LENGTHS - (Add Trim)	Scaling Diameters (5"- 7")	(8"- 11")	(12"-14")	OVERSIZED and (15" +)
32' - 40'	$520	$510	$470	$220
16' - 30'	$420	$410	$370	$120
LOGS LESS THAN 16', UTILITY LOGS and 12" plus 3 SAW LOGS	$50	$50	$50	$50

OVERSIZED LOGS (28" OR GREATER ANYWHERE ON THE LOG)

Eastside Log Price Screen

Species	Scaling Dia.	$ per Mbf
Ponderosa Pine	6" -11" 12" – 15" 16" – 19" 20" – 23" 24" +	$290 $385 $435 $490 $505
Lodge pole pine	6" +	$385
White fir	6" – 11" 12" +	$290 $310

Sensitive to scaling diameter, most logs 32 feet and shorter.

Cubic Volume

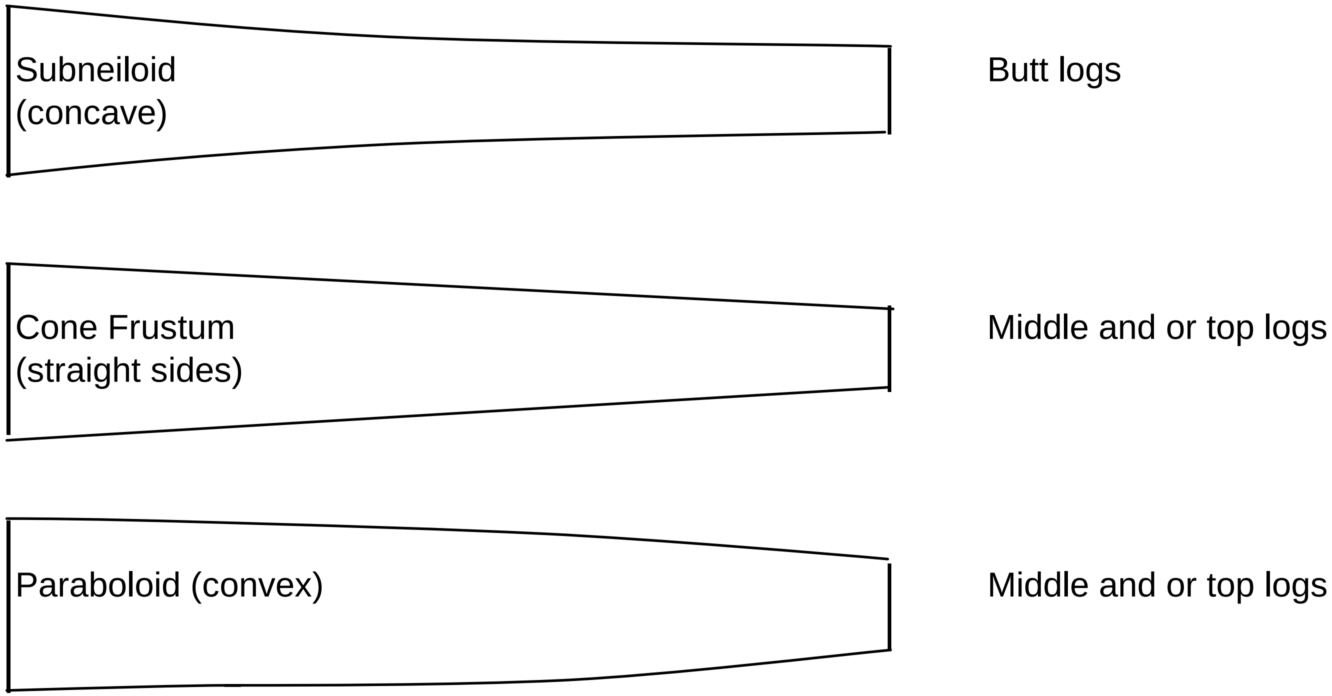
- Cubic volume calculated by a cone frustum (Smalian) will overstate the volume of a tree by a small percentage because the highest percentage of the volume occurs in the butt segment.
- This “under-run” is in the area of 1 to 5 percent.
  - This can be overcome by recognizing butt logs
  - Standard measurements for all logs, to the nearest inch and foot
- Remember scribner “over-run” may by 150 to 300 percent.
- Test scale for cubic foot to weight
- Cut scaling costs by weighing all loads and calculating cubic feet by species and log sort.

Cubic, Weight and the Shape of Logs

- Butt logs concave
- Upper stem logs convex
- Northwest cubic rules and smalian

The Shape of Logs

Cone Frustum is the form of Smalian and NW Cubic Rules



Butt logs make up the highest percentage of volume in trees.
Using cone frustum equations will overstate the cubic volume in trees.
Butt logs will have the greatest overstatement.

Weight Scaling

- Weight scaling is common in the USA, particularly in the South and Southeast where the trees and logs are relatively small.
- Logs are paid for by the ton.
- Weight per cubic foot does vary by species, time of year, and the size of the logs.
- A continuous program of measuring the cubic volume of a percentage of loads of logs that have been weighed can yield good volume information.

Weight Conversion Example

- This is an example of calculating tons per Mbf to decide which trees could be harvested and sold using weight.
- This is data from an actual cruise of a 70 year old high site Douglas-fir stand in Western Oregon. The data was computed with SuperACE, CCF and Mbf by DBH.
- Calculations for each DBH class
  - Tons - 5500 pounds times the CCF (100 cubic feet)
  - Tons / Mbf - Tons divided by Mbf (1000 board feet)
  - Avg. Tons / Mbf – Total tons divided by the total Mbf
- Notice the Total Mbf is the same as the original cruise data, but the Mbf in the 8 inch diameter class has nearly doubled and the price at $70 ton has become $1,506 per Mbf.
- In this example, all the trees 13 inches and smaller are worth more as ton wood than the average dollars per Mbf.

Weight Conversion Example from a Cruise Stand Table

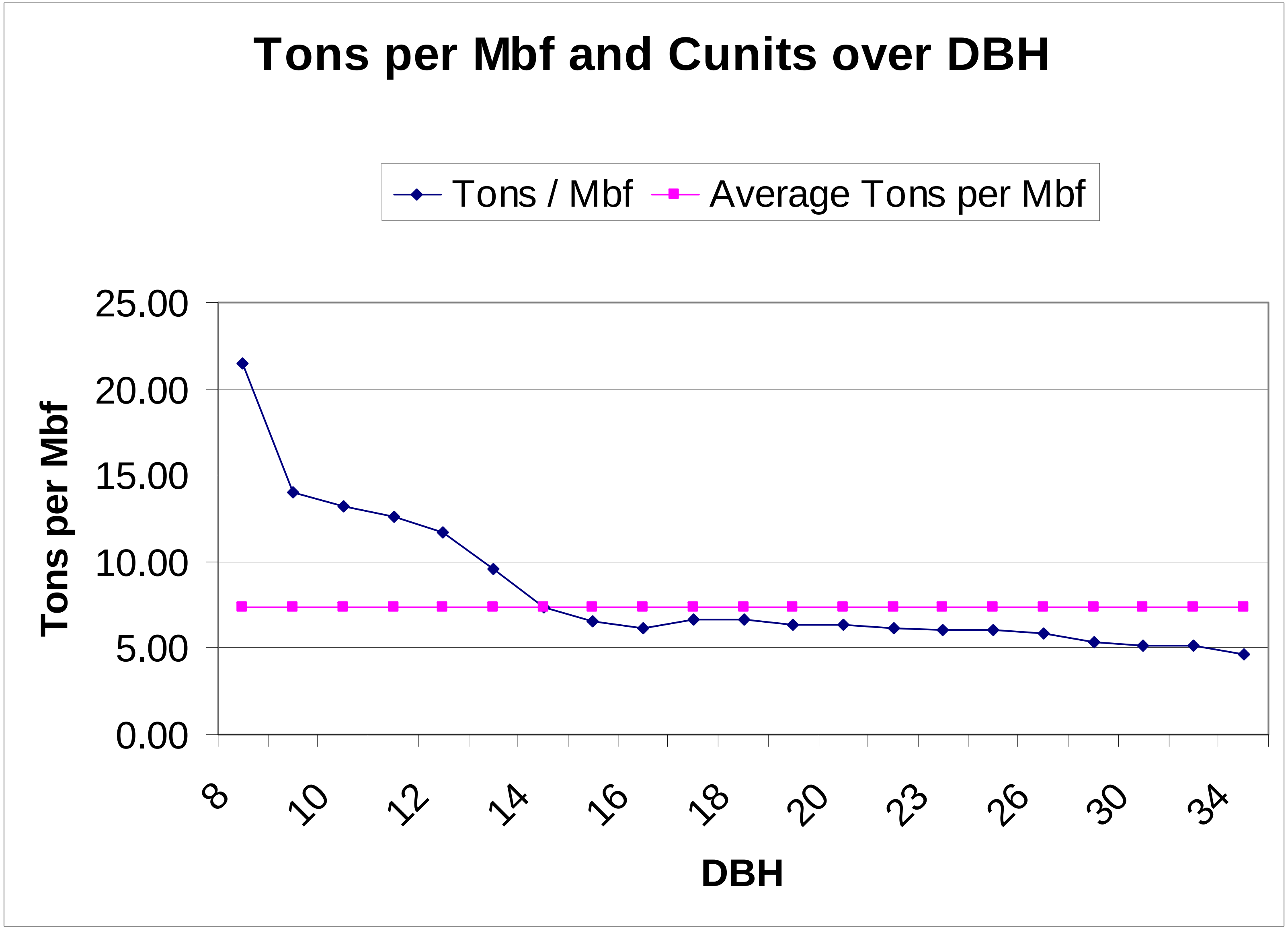
Toby Atterbury July 8, 2011

Douglas-fir Stand - Westside Scale

5500 Pounds per Cunit (100 cubic feet), CCF

$70.00 per ton

DBH	Avg. Total Ht.	Cunits CCF	Mbf	Tons	Tons / Mbf	Avg. Tons / Mbf	tons times average tons / Mbf	Diff	%	Total Dollars	Per Mbf	per CCF
8	45	7,894	1,009	**21,709**	**21.51**	7.376	2,943	1,934	192%	$1,519,595	$1,506.04	$192.50
9	53	13,442	2,633	**36,966**	**14.04**	7.376	5,012	2,379	90%	$2,587,585	$982.75	$192.50
10	56	44,385	9,258	**122,059**	**13.18**	7.376	16,548	7,290	79%	$8,544,113	$922.89	$192.50
11	58	36,100	7,904	**99,275**	**12.56**	7.376	13,459	5,555	70%	$6,949,250	$879.21	$192.50
12	62	33,410	7,867	**91,878**	**11.68**	7.376	12,456	4,589	58%	$6,431,425	$817.52	$192.50
13	75	74,084	21,174	**203,731**	**9.62**	7.376	27,621	6,447	30%	$14,261,170	$673.52	$192.50
14	98	10,127	3,799	**27,849**	**7.33**	7.376	3,776	(23)	-1%	$1,949,448	$513.15	$192.50
15	117	11,123	4,684	**30,588**	**6.53**	7.376	4,147	(537)	-11%	$2,141,178	$457.13	$192.50
16	118	4,241	1,908	**11,663**	**6.11**	7.376	1,581	(327)	-17%	$816,393	$427.88	$192.50
17	132	3,442	1,433	**9,466**	**6.61**	7.376	1,283	(150)	-10%	$662,585	$462.38	$192.50
18	140	41,178	17,123	**113,240**	**6.61**	7.376	15,352	(1,771)	-10%	$7,926,765	$462.93	$192.50
19	139	10,711	4,669	**29,455**	**6.31**	7.376	3,993	(676)	-14%	$2,061,868	$441.61	$192.50
20	140	67,727	29,145	**186,249**	**6.39**	7.376	25,251	(3,894)	-13%	$13,037,448	$447.33	$192.50
22	156	91,432	40,605	**251,438**	**6.19**	7.376	34,089	(6,516)	-16%	$17,600,660	$433.46	$192.50
23	143	78,431	35,571	**215,685**	**6.06**	7.376	29,242	(6,329)	-18%	$15,097,968	$424.45	$192.50
24	156	67,850	30,664	**186,588**	**6.08**	7.376	25,297	(5,367)	-18%	$13,061,125	$425.94	$192.50
26	146	10,132	4,761	**27,863**	**5.85**	7.376	3,778	(983)	-21%	$1,950,410	$409.66	$192.50
28	160	4,001	2,051	**11,003**	**5.36**	7.376	1,492	(559)	-27%	$770,193	$375.52	$192.50
30	162	2,480	1,315	**6,820**	**5.19**	7.376	925	(390)	-30%	$477,400	$363.04	$192.50
32	162	2,671	1,423	**7,345**	**5.16**	7.376	996	(427)	-30%	$514,168	$361.33	$192.50
34	174	1,125	663	**3,094**	**4.67**	7.376	419	(244)	-37%	$216,563	$326.64	$192.50
Total		**615,986**	**229,659**	**1,693,962**	**7.376**	**7.376**	**229,659**	0	0%	**$118,577,305**	**$516.32**	**$192.50**


Tons per Mbf and Cunits over DBH
Tons / Mbf
Average Tons per Mbf
25.00
20.00
15.00
10.00
5.00
0.00
Tons per Mbf
8
10
12
14
16
18
20
23
26
30
34
DBH

Log Grading and or Log Sorts

- All logs are different
- They are generally sorted by species, size, & quality in the woods and sent to various processing plants
- They are then scaled:
  - Species, diameter, length, grades, defects
  - Then processed by the mill into products

World Standard for Wood Volume

- **Cubic Meters**
- 35.31 Cubic Feet in a cubic meter
- How many cubic meters in an Mbf?
  - Depends on species, board foot scaling rule, taper, log sizes
  - Always from historical data or our best guess

The USA is a world trader. In 2011 the wood products industry got a real boost from the China market for both lumber and logs.

Wood Products

- Lumber and plywood for buildings
- Poles and Piling
- Chips and sawdust for pulp and paper
- Bark for our gardens
- Biomass for energy
- Carbon storage in these products
- New forest to grow more trees and store more carbon

Estimating Value Recovery

- Scribner – Extrapolate
  - Overrun on boards
    - Mbf 100 Mbm 250
    - This will change with log size and taper
  - Plus:
    - Chips
    - Sawdust
    - bark
- Cubic Feet – Interpolate
  - Boards 55%
  - Chips 35%
  - Sawdust 10%

Scribner and Overrun

- Scribner scale has been used in our industry for 160 years.
- It estimates how much lumber could be produced by mills 160 years ago.
- Scribner is part of our tradition
- Mills recover 2 or 3 times the lumber estimated by this rule plus chips, sawdust, and bark.
- Mills have estimates of overrun by species, sizes, and grades, until something changes

Scribner and Cubic

- Scribner
  - Advantages
    - Most familiar to us
    - A Tradition
    - Mills get “overrun”
    - Lots of historical data
    - Only one end of log measured
  - Disadvantages
    - Does not measure volume
    - Poor weight relationships
    - Not useful for estimating biomass, carbon
    - Extrapolate to Boards, chips, sawdust
- Cubic
  - Advantages
    - Measures volume
    - Related to weight
    - Interpolate to boards, chips, sawdust
    - Can lower cost with weighing and test scaling
    - Utilize scanners, lasers
  - Disadvantages
    - Users not familiar cubic
    - No “overrun”
    - No historical data

"2011 Science Accomplishments"
Pacific Northwest Research Station

Over the past 40 years, sawmills in the western USA have become more efficient. They now produce more lumber while using less timber. This efficiency occurred even as the size of logs used by sawmills decreased. This finding, based on a review of forest industry surveys, meant the primary technique for estimating lumber production based on volume of harvest wood was now outdated.

The Scribner Log Rule was developed in 1846 and was designed to estimate board foot volume that could be produced from a log. As the wood-processing industry has diversified to produce not only lumber but pulp, composite panels, and wood-based fuels, the industry needs to be able to accurately estimate the volume of wood fiber available for use.

Thus, scientists updated conversion rates and recovery factors that are essential for estimating production efficiency, timber supply and demand, and whole-tree volume, which is required for biomass assessments and carbon accounting. Contact: Jean Daniels, jdaniels@fs.fed.us,Goods,Services,and Values Program

Scribner's Publications

- Scribner's Ready Reckoner and Log Book for *Ship Builders, Boat Builders, and Lumber Merchants*
- Published 1870

- Scribner's Lumber & Log Book for *Ship Builders, Boat Builders, and Lumber Merchants*
- Published 1897
- Doyle's Rule page 58

Biomass, Carbon Credits

- New to the scene:
  - Biomass to produce energy products
    - Where is the extra wood?
    - How much does it cost to deliver?
  - Carbon credits
    - How much carbon does a forest hold?
    - How much is lost when we log?
    - How much do we gain with annual growth?
    - How much is lost when we use substitute products?

How Can We Measure Trees and Logs for more Useful Information?

- I believe it is Time use Cubic Volume as our Primary Measure of Logs
- Scribner has served a long and useful life, but does not help with weight scaling and helping us reduce costs and improve useful information.

Water Transportation for Lumber and Logs

Air Transportation for Logs

Old Technology Fading Away

Thank you for your kind attention.

Source Information

- Official Rules for the following Log Scaling and Grading Bureaus
  - Columbia River, Northern California, Pacific Rim, Yamhill
  - Northwest Log Rules, Eastside and Westside Log Scaling Handbook
  - January 1, 2011 Edition
- Supplement to Official Log Scaling and Grading Rules
- A Collection of Log Rules U.S.D.A. Forest Service General Technical Report by Frank Freese – 1982???
- Scribner's Ready Reckoner and Log Book for Ship Builders, Boat Builders, and Lumber Merchants by J. M. Scribner, 1857, 1870
- Scribner's Enlarged Lumber & Log Book by J. M. Scribner. 1897
- Forest Products Measurements and Conversion Factors College of Forest Resources, University of Washington 1994
- Idaho Log Scaling Manual, Scribner Decimal "C" Measurement Rules, Idaho Board of Scaling Practices 2008 Edition

Source Information

- The Dictionary of Forestry, Society of American Foresters, 1998
- Basic Wood Measurements – Crown Zellerbach – D.H. Baisinger January 1963
- Forestry Handbook, Society of American Foresters, 1955
- Tables for Estimating Board-Foot Volume of Timber, 1946, Clement Mesavage, USDA
- Board Foot Volume Tables for 32 Foot Logs – James Girard and Donald Bruce – Early 1950s
- A First Book of Forestry – 1902 – Filibert Roth
- National Forest Log Scaling Handbook USDA Forest Service, 4/20/2006
- Impact of Board Foot to Cubic Foot Volume Conversions in the U.S.-Canada Softwood Lumber Trade Dispute – May 6, 2003 Jendro & Hart LLC