Changing the Rules

1. Characteristics of a Good Measurement System
2. How Scribner & Cubic "Measure-Up"
3. Making the Change to the Better Measure – Cubic!

Ten key characteristics of effective and reliable metrics

1. Is quantitative
2. Is easy to understand
3. Encourages appropriate behavior
4. Is visible (*not a black box*)
5. Is defined and mutually understood
6. Encompasses both outputs and inputs
7. Measures only what is important
8. Is multidimensional (*or multi-use*)
9. Uses economies of effort
10. Facilitates trust

A good measure:	Description:
Is quantitative	The measure can be expressed as an objective value
Is easy to understand	The measure conveys at a glance what it is measuring, and how it is derived
	The measure is balanced to reward productive behavior and discourage "game playing"
	The effects of the measure are readily apparent to all involved in the process being measured
	The measure has been defined by and/or agreed to by all key process participants (internally and externally)
	The measure integrates factors from all aspects of the process measured
	The measure focuses on a key performance indicator that is of real value to managing the process
	The measure is properly balanced between utilization, productivity, and performance, and shows the trade-offs
	The benefits of the measure outweigh the costs of collection and analysis
	The measure validates the participation among the various parties

A good measurement system:

	Scribner	Cubic
1. Is Quantitative	✓	✓
2. Is Easy to Understand		
3. Encompasses both outputs and inputs		
4. Encourages appropriate behavior		
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6. Facilitates trust		

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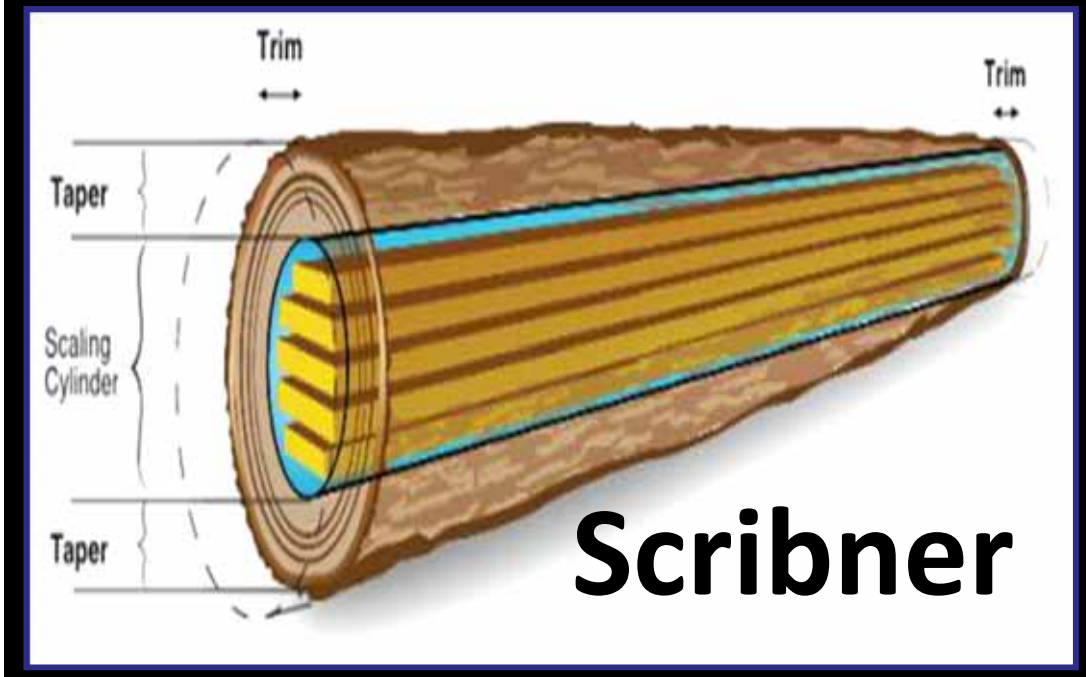
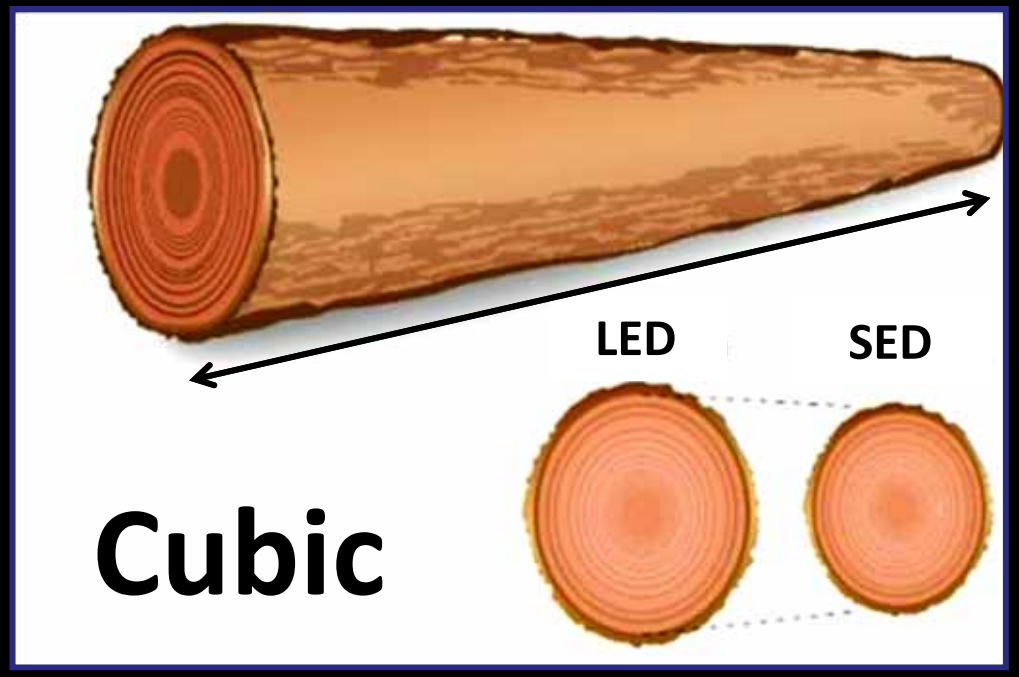


Scribner



Cubic

1. 1” x 4” or wider boards in 2” multiples
2. Assumes One Quarter Inch Saw Kerf
3. Short Log or Long Log Version?
4. Diameters Rounded or Truncated?
5. Nearest 1 bf or Nearest 10 bf?
6. Confusing term of the “board foot”

Derivation of cubic scale is straightforward and intuitive

A good measurement system:

	Scribner	Cubic
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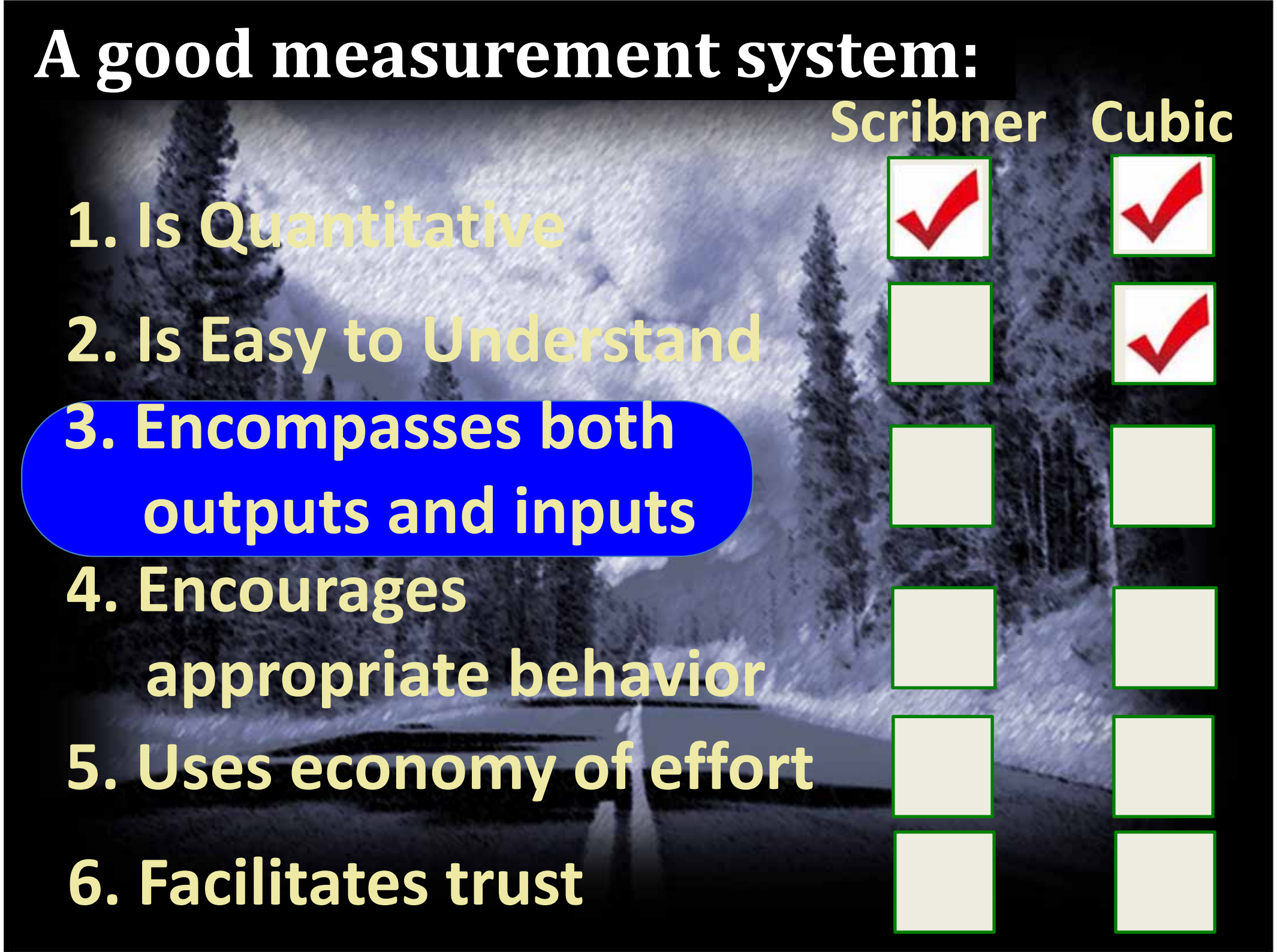

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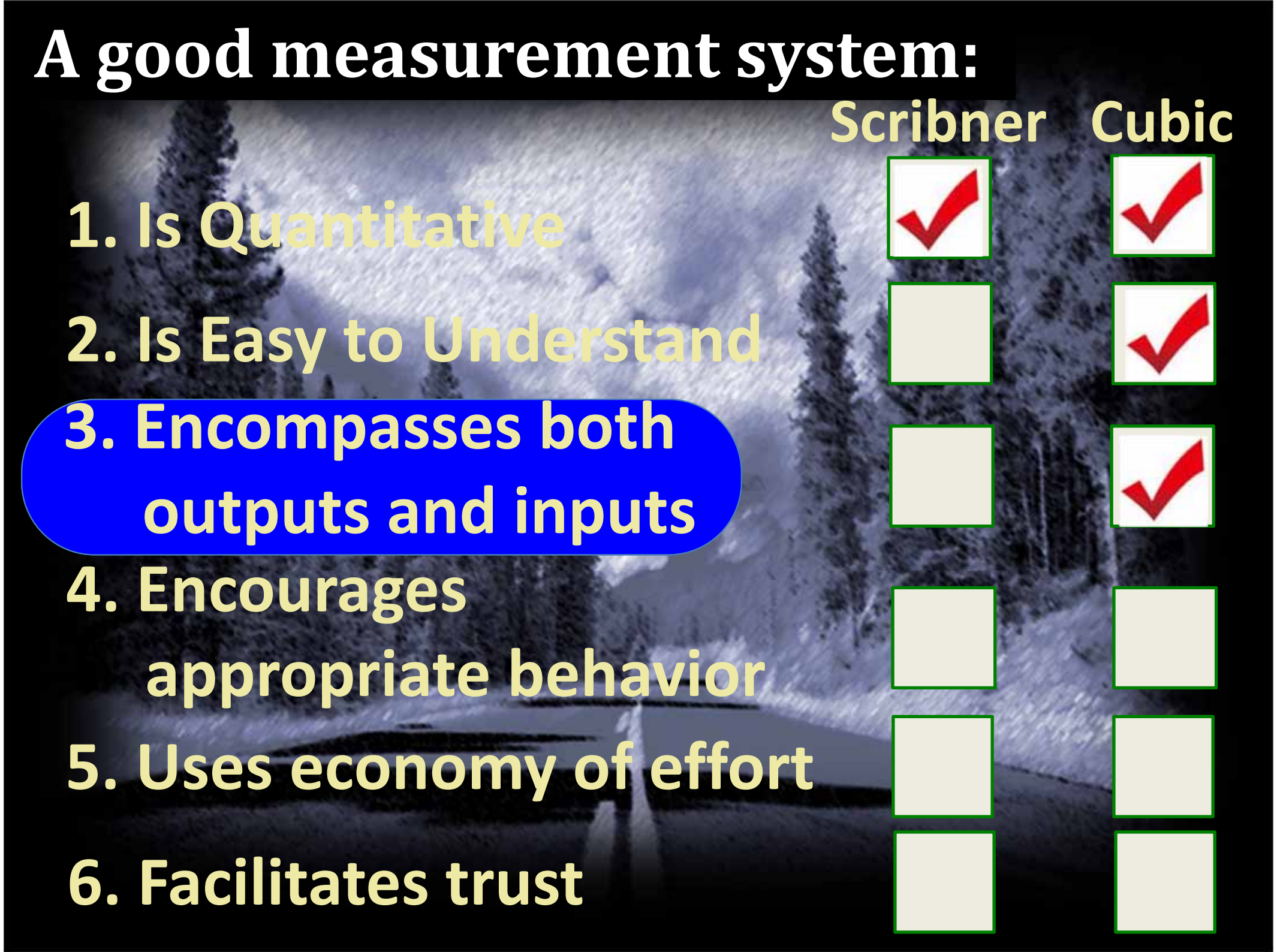
A good measurement system:

Is capable of integrating factors from all aspects of the process

Only Cubic is capable of measuring all product output as well as log input

A good measurement system:



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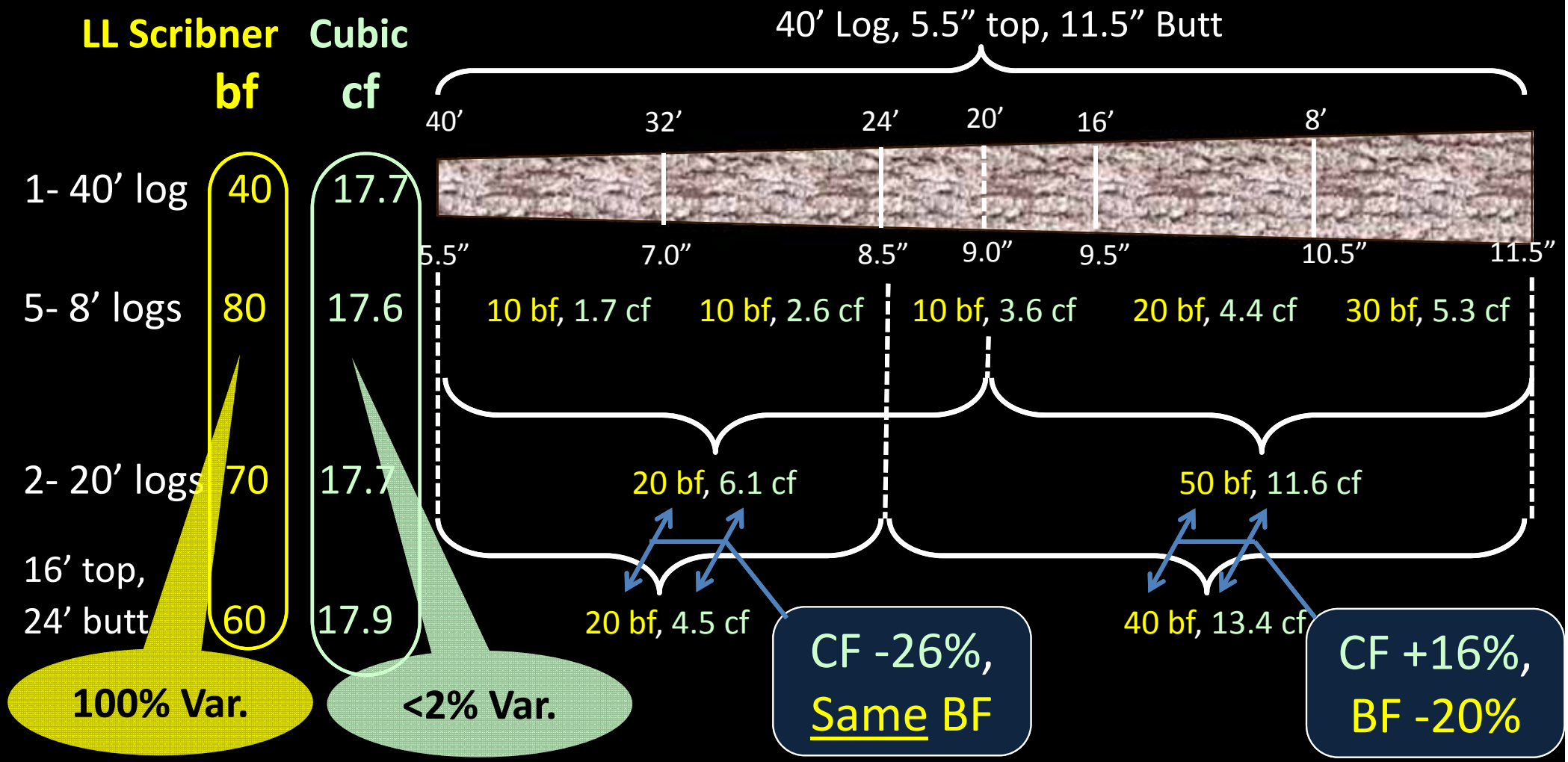
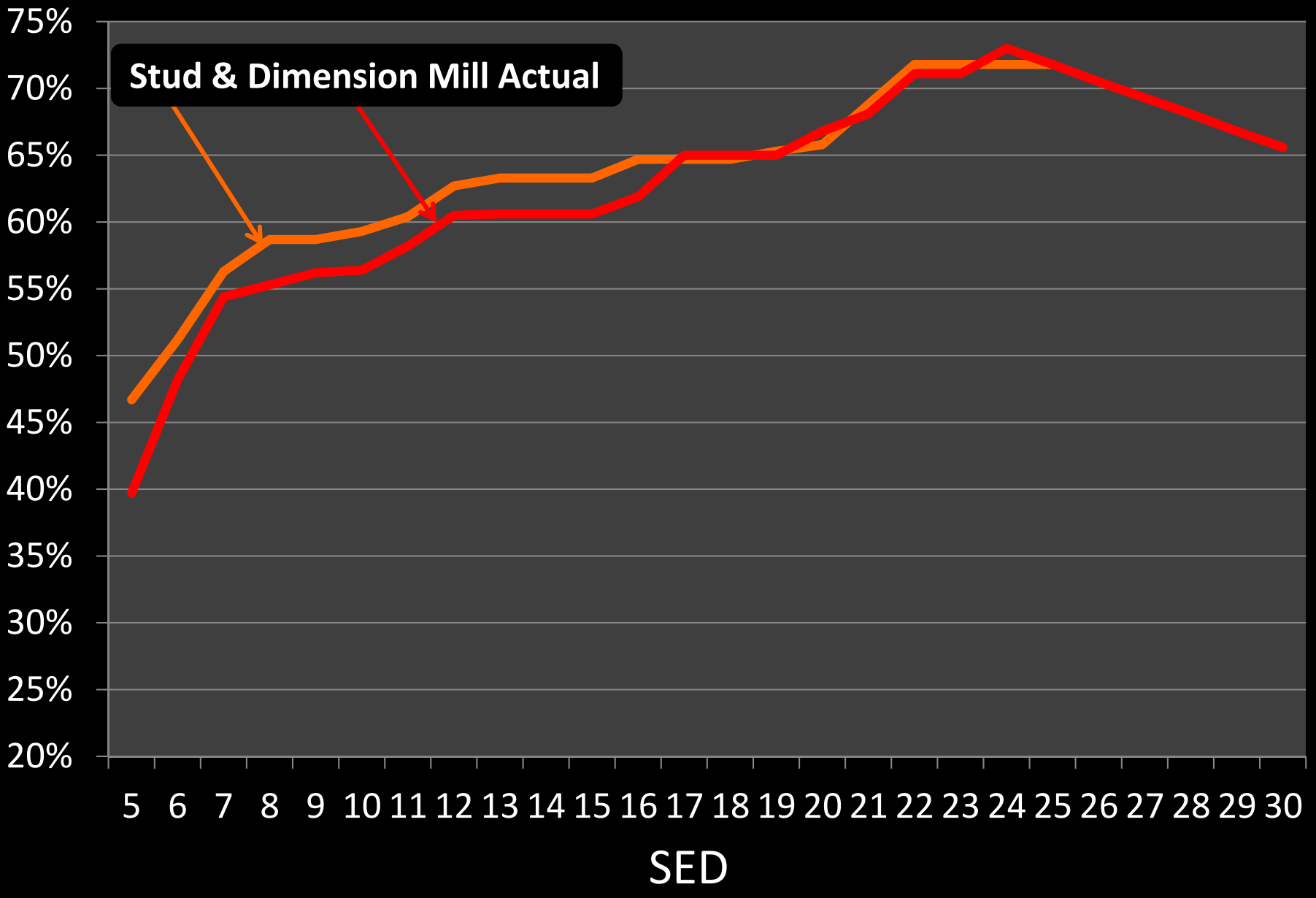
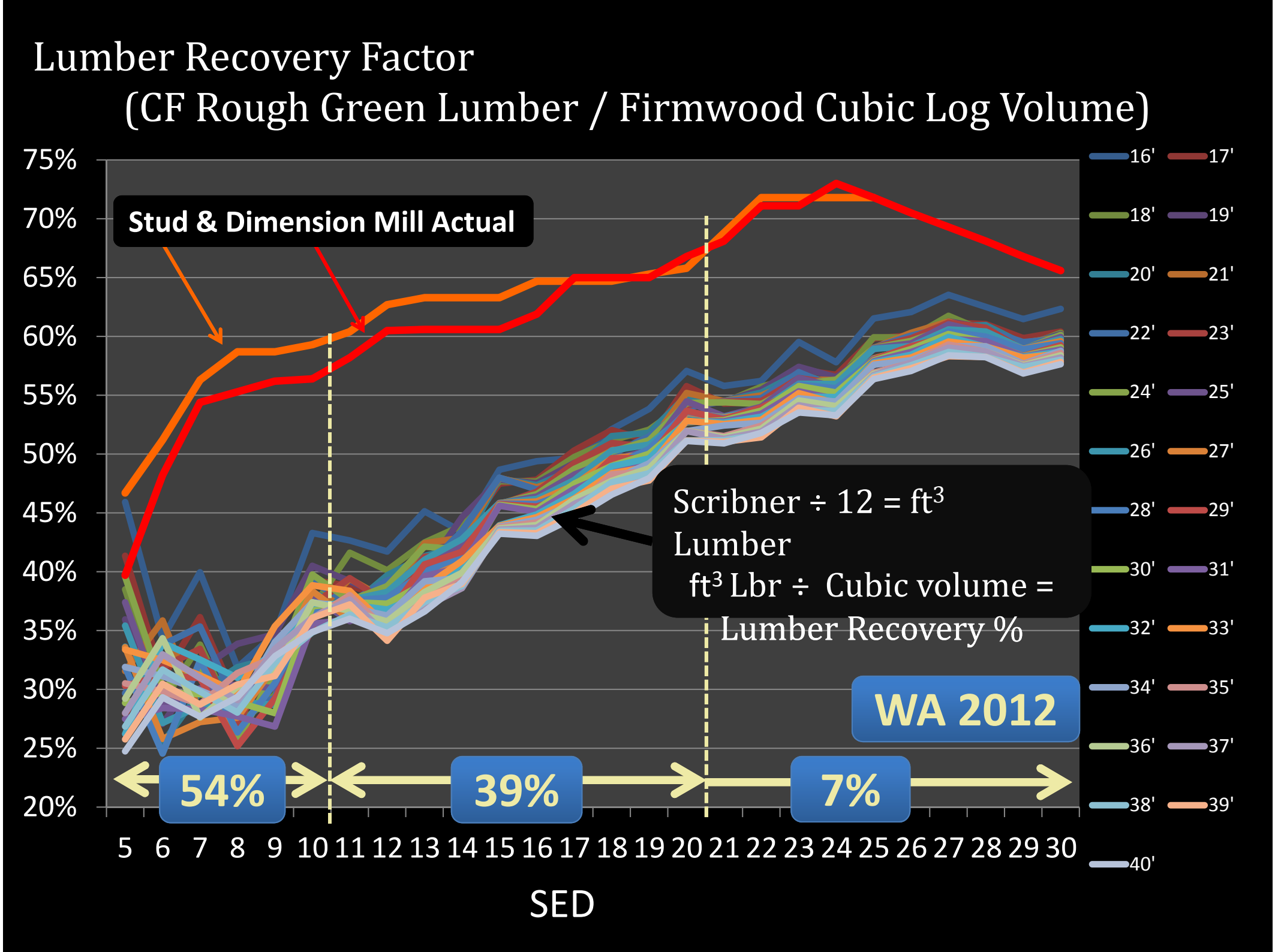


Lumber Recovery Factor - Stud & Dimension Mills
(CF Rough Green Lumber / Firmwood Cubic Log Volume)



Source: Fonseca 2005 (*Steele et al., 1991*)


Lumber Recovery Factor
(CF Rough Green Lumber / Firmwood Cubic Log Volume)
75%
70%
65%
60%
55%
50%
45%
40%
35%
30%
25%
20%
Stud & Dimension Mill Actual
Scribner ÷ 12 = ft3
Lumber
ft3 Lbr ÷ Cubic volume =
Lumber Recovery %
WA 2012
54%
39%
7%
5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
SED
16' 17'
18' 19'
20' 21'
22' 23'
24' 25'
26' 27'
28' 29'
30' 31'
32' 33'
34' 35'
36' 37'
38' 39'
40'

Lumber Recovery Factor
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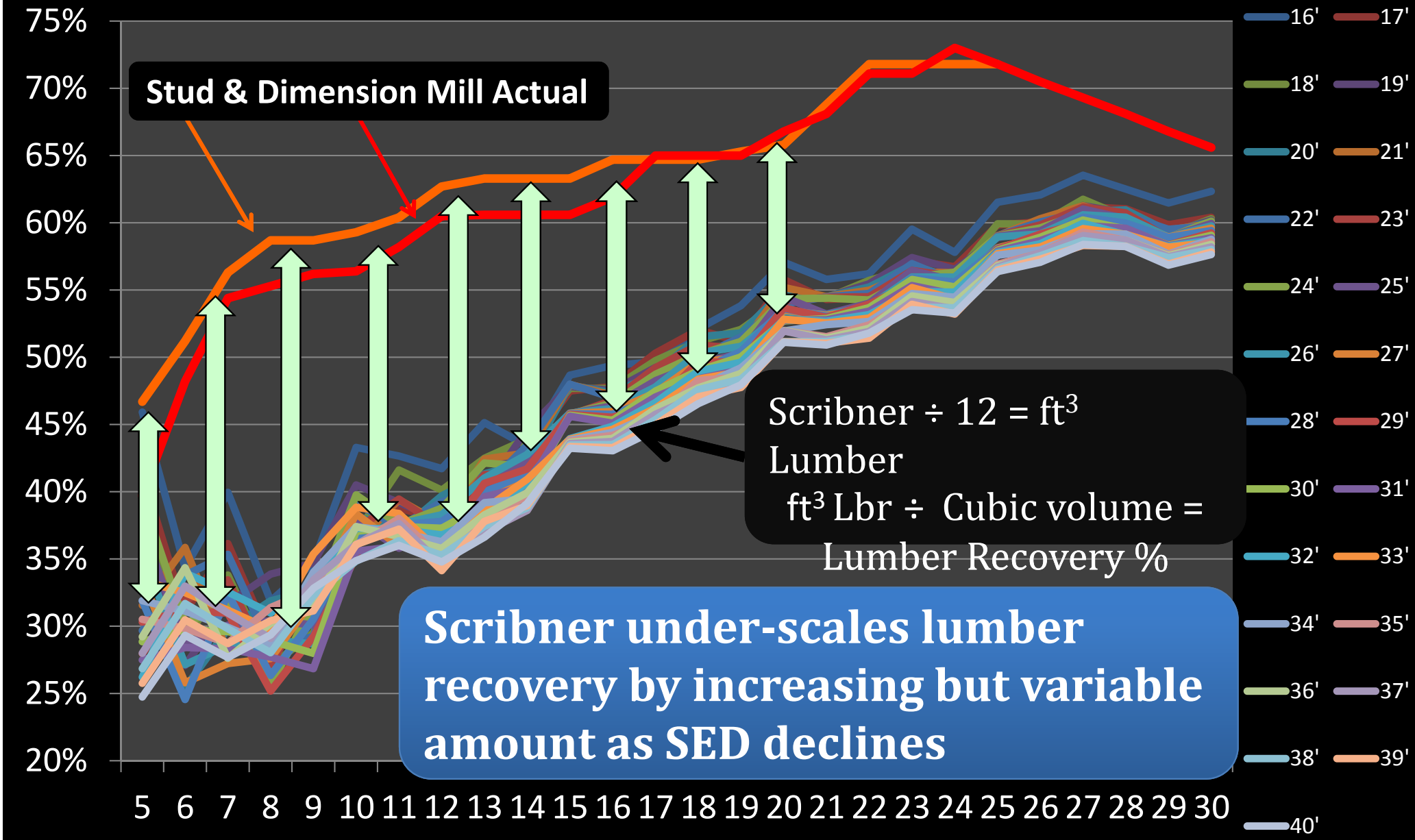

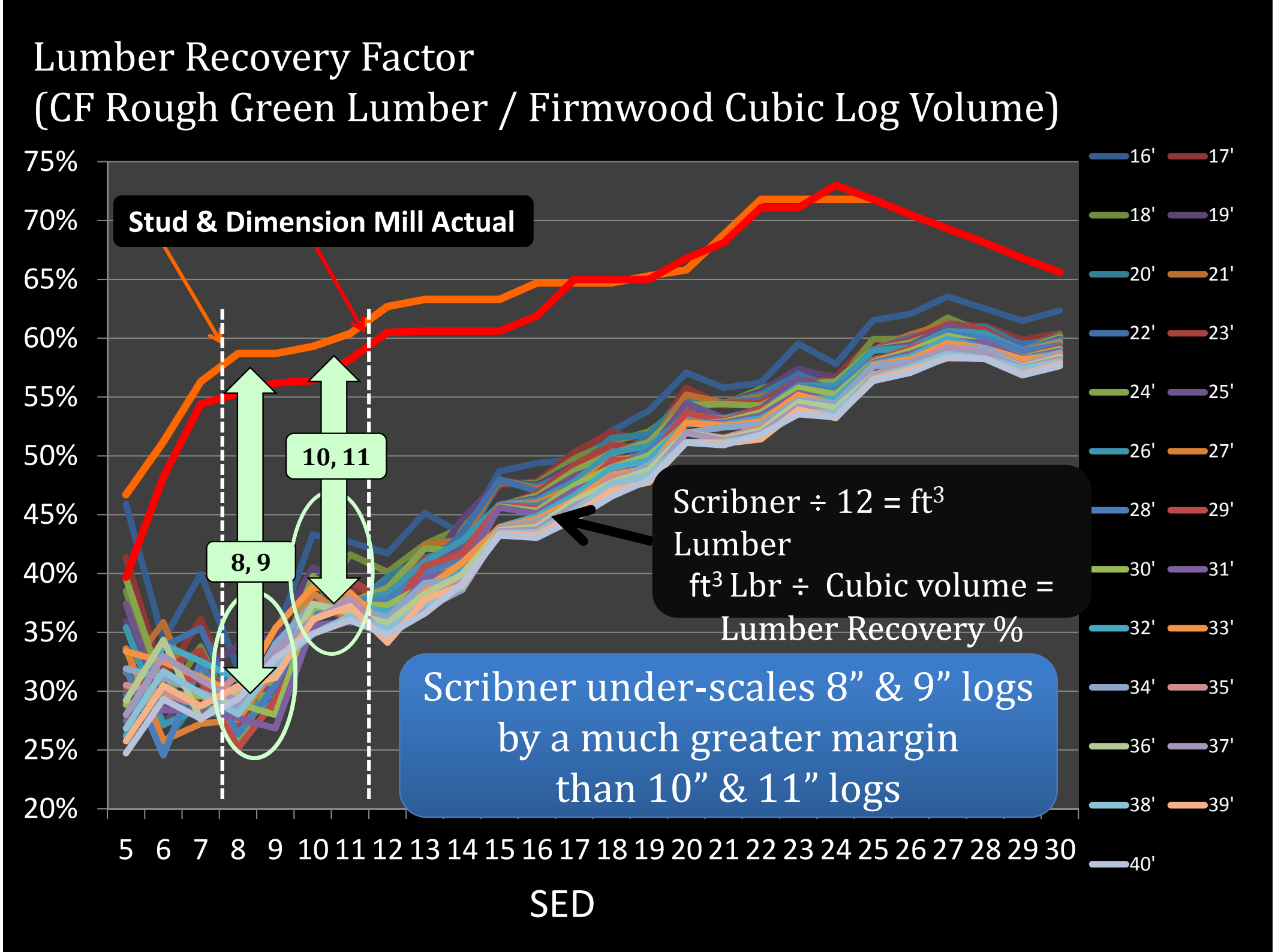
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(CF Rough Green Lumber / Firmwood Cubic Log Volume)
75%
70%
65%
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50%
45%
40%
35%
30%
25%
20%
Stud & Dimension Mill Actual
10, 11
8, 9
Scribner ÷ 12 = ft3 Lumber
ft3 Lbr ÷ Cubic volume = Lumber Recovery %
Scribner under-scales 8” & 9” logs by a much greater margin than 10” & 11” logs
5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
SED
16' 17' 18' 19' 20' 21' 22' 23' 24' 25' 26' 27' 28' 29' 30' 31' 32' 33' 34' 35' 36' 37' 38' 39' 40'

8” – 11” Logs Commonly Marketed As Single Sort

Douglas Fir - Long (26 - 40')

Diameter	Sort
8 - 11"	11
12" Plus 26 - 30'	14
12" Plus 32 - 40'	15
Low-Grade -3 + knots & 6-7"	13
16" + 32' - 40' SM & High-Line #2	16
Pulp	19

Hemlock - Long (26 - 40')

Diameter	Sort
8 - 11"	31
12" Plus 26 - 30'	34
12" Plus 32 - 40'	35
16" + 32' - 40' SM & High-Line #2	36
Low-Grade/6-7"	33
Pulp	39

Hemlock						
KH	K	12"+		30-40'	MEDIUM Quality Export	No Red paint
KHS	H	8"-11"		30-40'	MEDIUM Quality Export	No Red paint
CH	C	12"-22"	40"	30-40'	LOW Quality Export	No Red paint
CHS	L	8"-11"		30-40'	LOW Quality Export	No Red paint
DHO	CIR S	12"+		16'-40'	Domestic Saw Log	
DHS	S	8-11"	18	16-40'	Domestic Saw Log	
DHS	S	8-11"	19+	16-40'	Domestic Saw Log	
HX		5-7"	18	16-40'	Chip & Saw	
PH	HP BLUE DOT			8'+	PULP	

Source: 2013 TMS presentation “NWLRAG Log Grades vs. Log Sorts”, Mike Belfry

Scribner Unit Price Illusions

Sold for $40,000

BC Firmwood Cubic:
612 m^3 @ $65/$m^3$

LL Scribner:
$40,000 / 85.16 mbf = $470/mbf

SED	# Logs	LL Scribner mbf	$/mbf	Total $	Firmwood Cubic m^3	$/$m^3$
8” - 9”	422	33.05	$470	$15,524	265	$59
					347	$71
10” - 11”	408	52.11	$470	$24,476	612	$65

20%

Scribner Unit Price Illusions

Mix of diameter and taper within 8”-11” Sort depends on character of timber harvested.

To maintain a target wood cost Scribner price has to <u>decrease</u> as average diameter <u>increases</u>

DNR Timber Sale	8”-11” Sort 8-9”	8”-11” Sort 10-11”	Ave. SED	Scribner price needed for $65/m^3 wood cost
Wagonwheel PC	65%	35%	9.7”	$493
Pancake	53%	47%	9.9”	$482
One Horn	48%	52%	10.0”	$478
Linnaeus	39%	61%	10.2”	$470
Last Trip	31%	69%	10.3”	$463
Iroko	23%	77%	10.5”	$456
Columbo	11%	89%	10.7”	$445

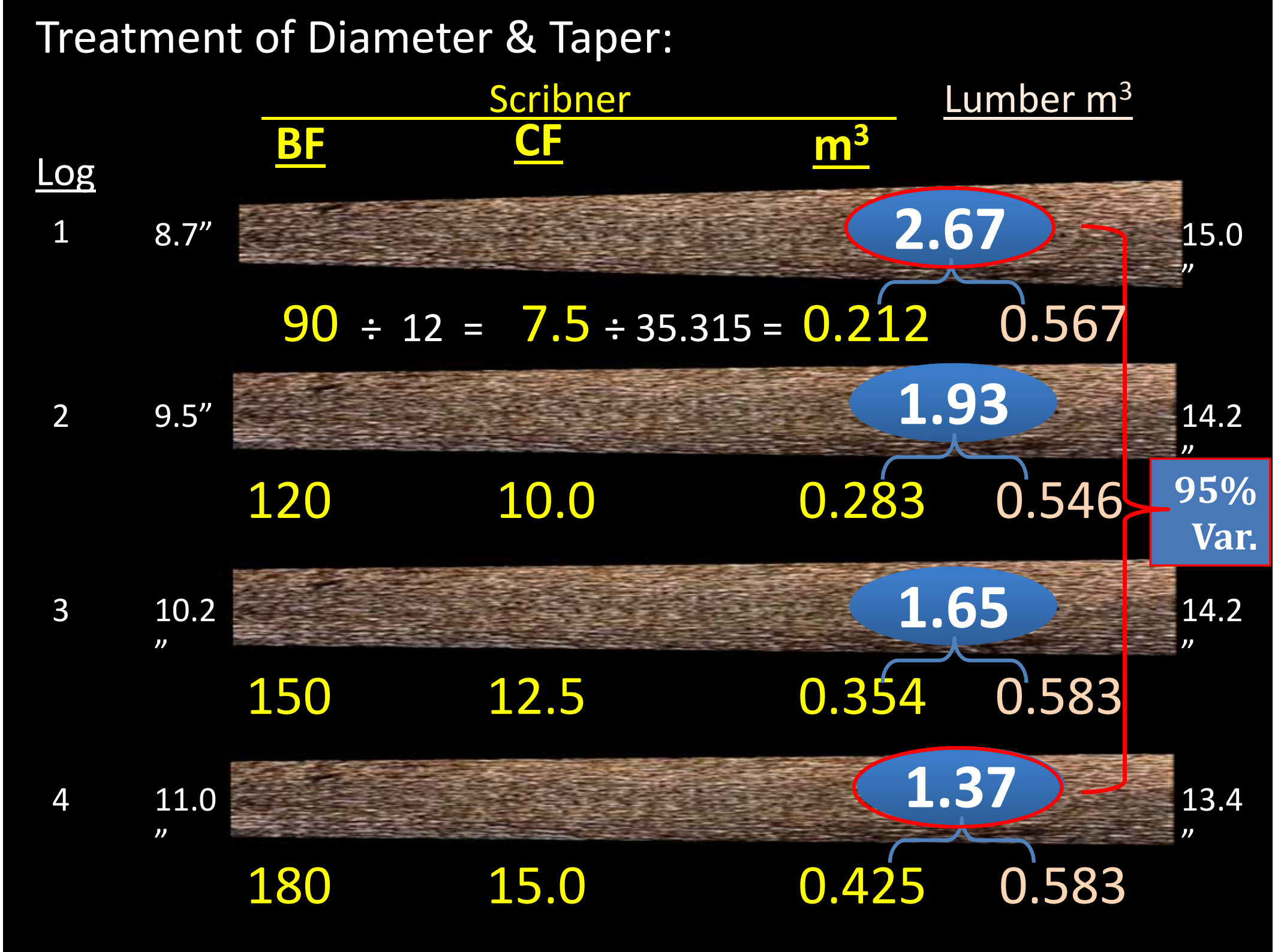
11 %

Treatment of Diameter & Taper:

40’ plus trim

Log		Scribner bf	Cubic m^3	Recovery Factor	Lumber m^3	
1	8.7”	90	0.946	x 0.599	= 0.567	15.0”
2	9.5”	120 +33%	0.912	x 0.599	= 0.546 -4%	14.2”
3	10.2”	150 +67%	0.968	x 0.602	= 0.583 +3%	14.2”
4	11.0”	180 +100%	0.952	x 0.612	= 0.583 +3%	13.4”

Treatment of Diameter & Taper:



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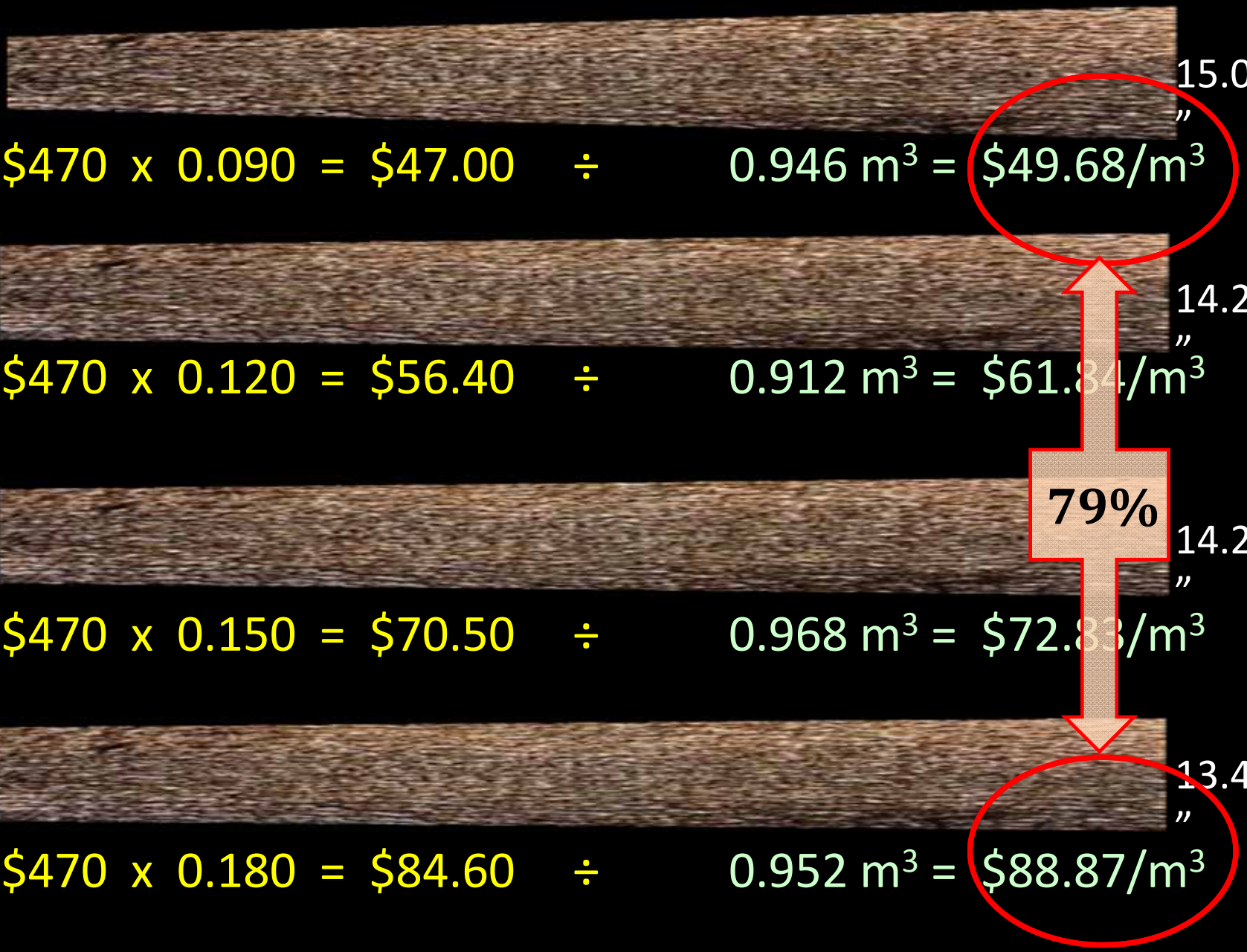
4	11.0 ”	180	0.952	x 0.612	= 0.583	13.4 ”

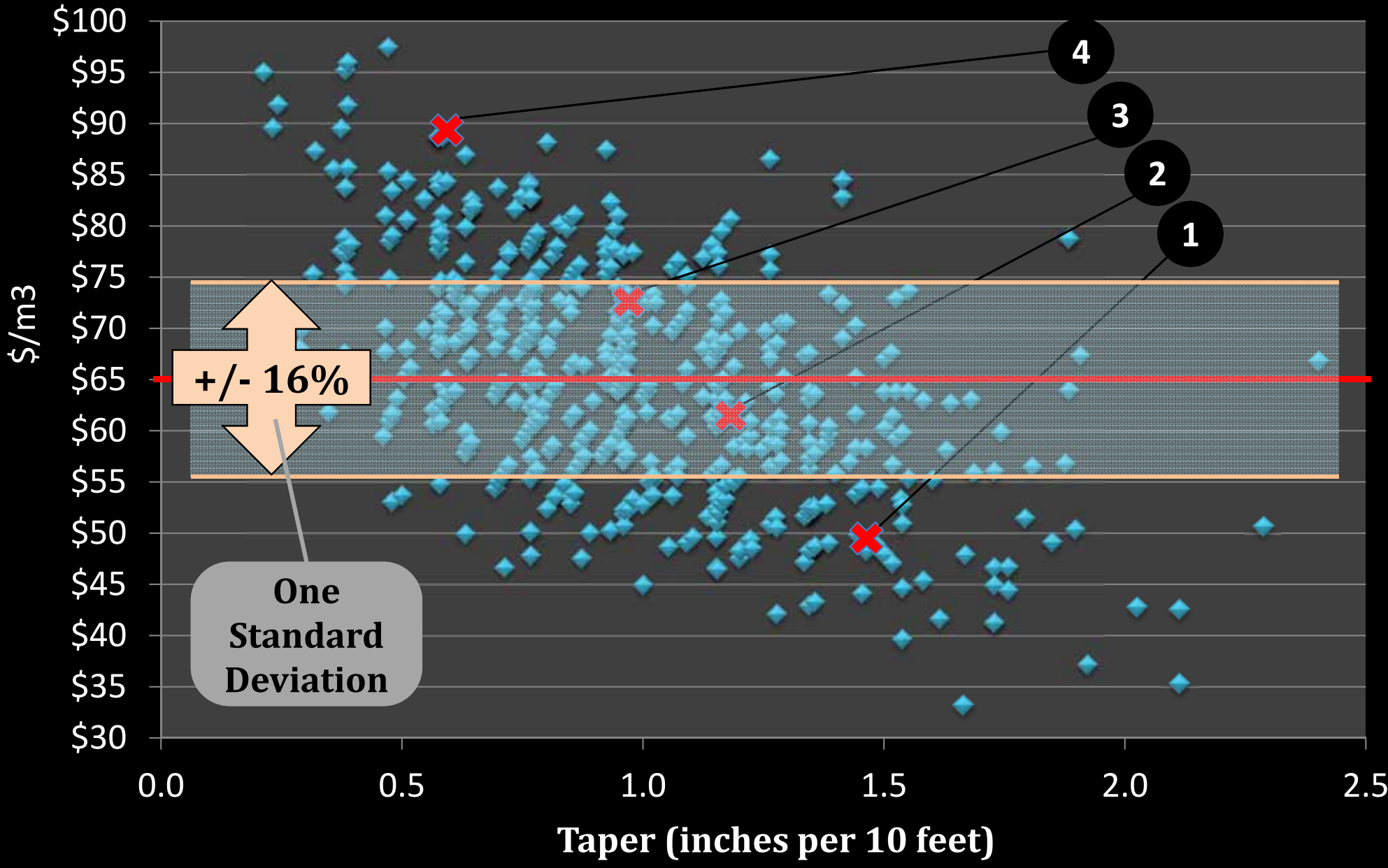
2% Var.

Treatment of Diameter & Taper:

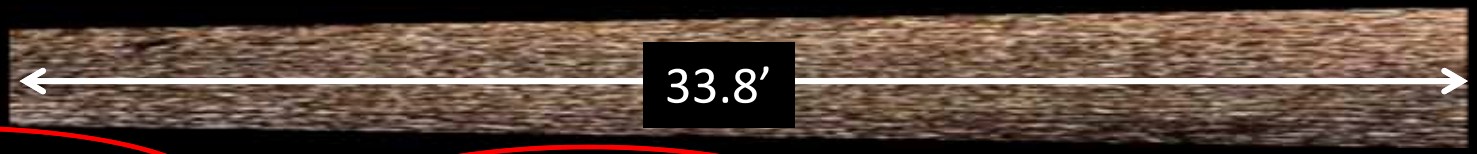
Log		LL Scribner @ $470/MBF	Firmwood Cubic
1	8.7”	$470 x 0.090 = $47.00 ÷	0.946 m^3 = $49.68/$m^3$
2	9.5”	$470 x 0.120 = $56.40 ÷	0.912 m^3 = $61.84/$m^3$
3	10.2”	$470 x 0.150 = $70.50 ÷	0.968 m^3 = $72.83/$m^3$
4	11.0”	$470 x 0.180 = $84.60 ÷	0.952 m^3 = $88.87/$m^3$



Wood cost per m^3 for 830 hemlock logs priced at $470/MBF Scribner



Treatment of Length: (logs with 9.4” top and 11.8” butt)

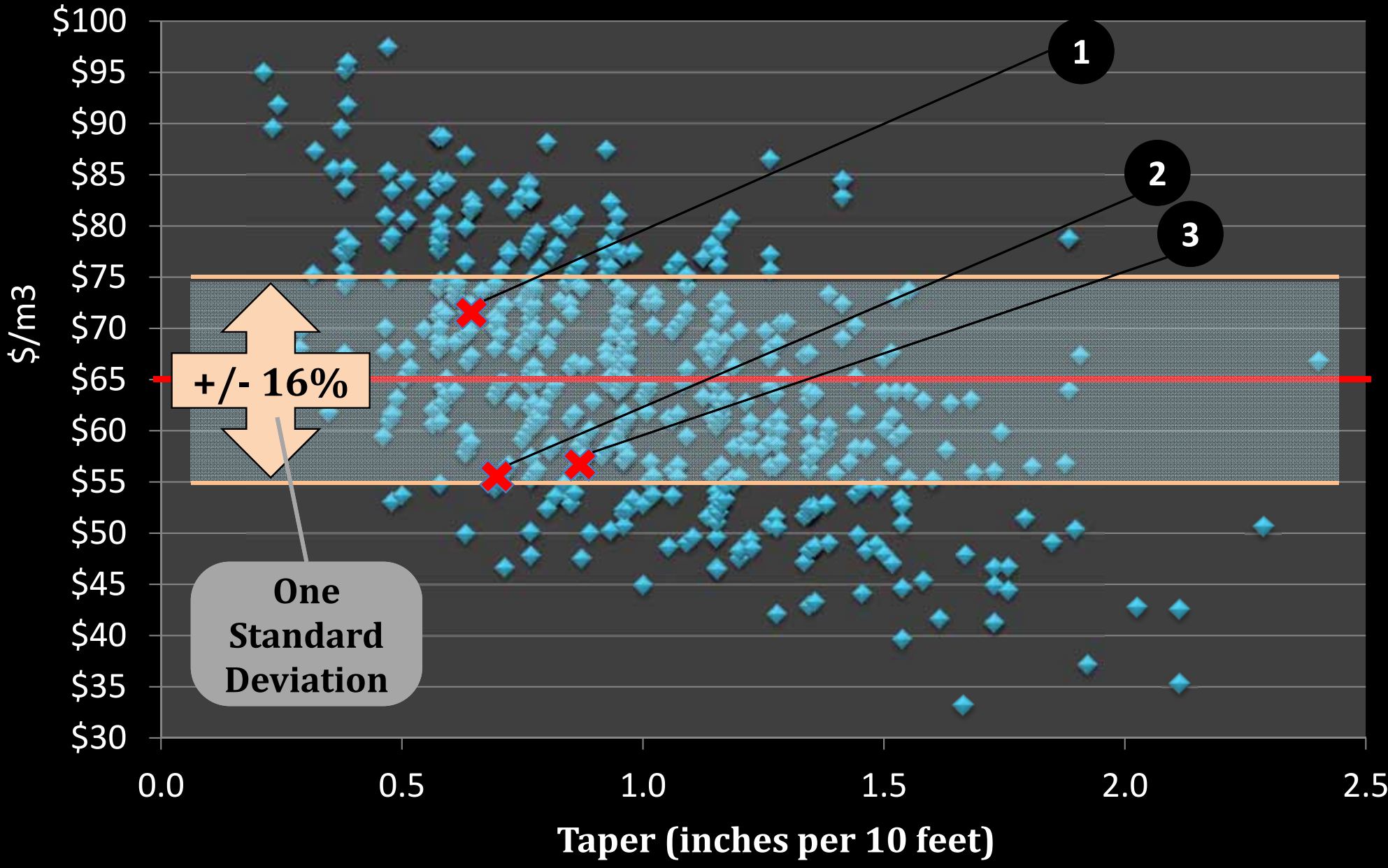
Log	LL Scribner Scale Length - bf Vol.				Firmwood Cubic m^3	
1						
	Gross: 36’ – 100		Net: 36’ – 100		0.655	
2						
	Gross: 33’ – 100	*-0%*	Net: 31’ – 70	*-30%*	0.597	*-9%*
3						
	Gross: 27’ – 70	*-30%*	Net: 26’ – 60	*-40%*	0.491	*-25%*

Treatment of Length: (logs with 9.4” top and 11.8” butt)

Log	LL Scribner @ $470/MBF	Firmwood Cubic $/m³
1	 $470 x 0.100 = $47.00 ÷	0.655 m³ = $71.76/m³
2	 $470 x 0.070 = $32.90 ÷	0.597 m³ = $55.11/m³
3	 $470 x 0.060 = $28.20 ÷	0.491 m³ = $57.43/m³

30%

Wood cost per m^3 for 830 hemlock logs priced at $470/MBF Scribner



Scribner's length bias

One foot difference in scale length from 32' to 31' is 3% in Firmwood cubic volume for all SED (1 ÷ 32 = 0.03)

In Scribner the volume difference varies from 6% to 22% for logs with SED from 6" through 12":

SED: Length	6"	7"	8"	9"	10"	11"	12"
31'	40	50	60	70	110	130	150
32'	50	60	70	90	120	140	160
Diff. from 32':	20%	17%	14%	22%	8%	7%	6%

Scribner discourages manufacturing logs with a 31 foot scale length

Scribner's length bias

Effects unit costs ($/MBF) of all production activities

For example:

Assume trucking is $200/trip to haul 54,000 lbs of 6-9" logs:

Log Length	# of logs in load	Scribner bf	Trucking Cost in $/MBF	Cubic m^3	Trucking Cost in $/m^3$
33.0'	53	3,570	$56.02	26.35	$7.59
32.0'	55	3,020	$66.23	26.51	$7.54

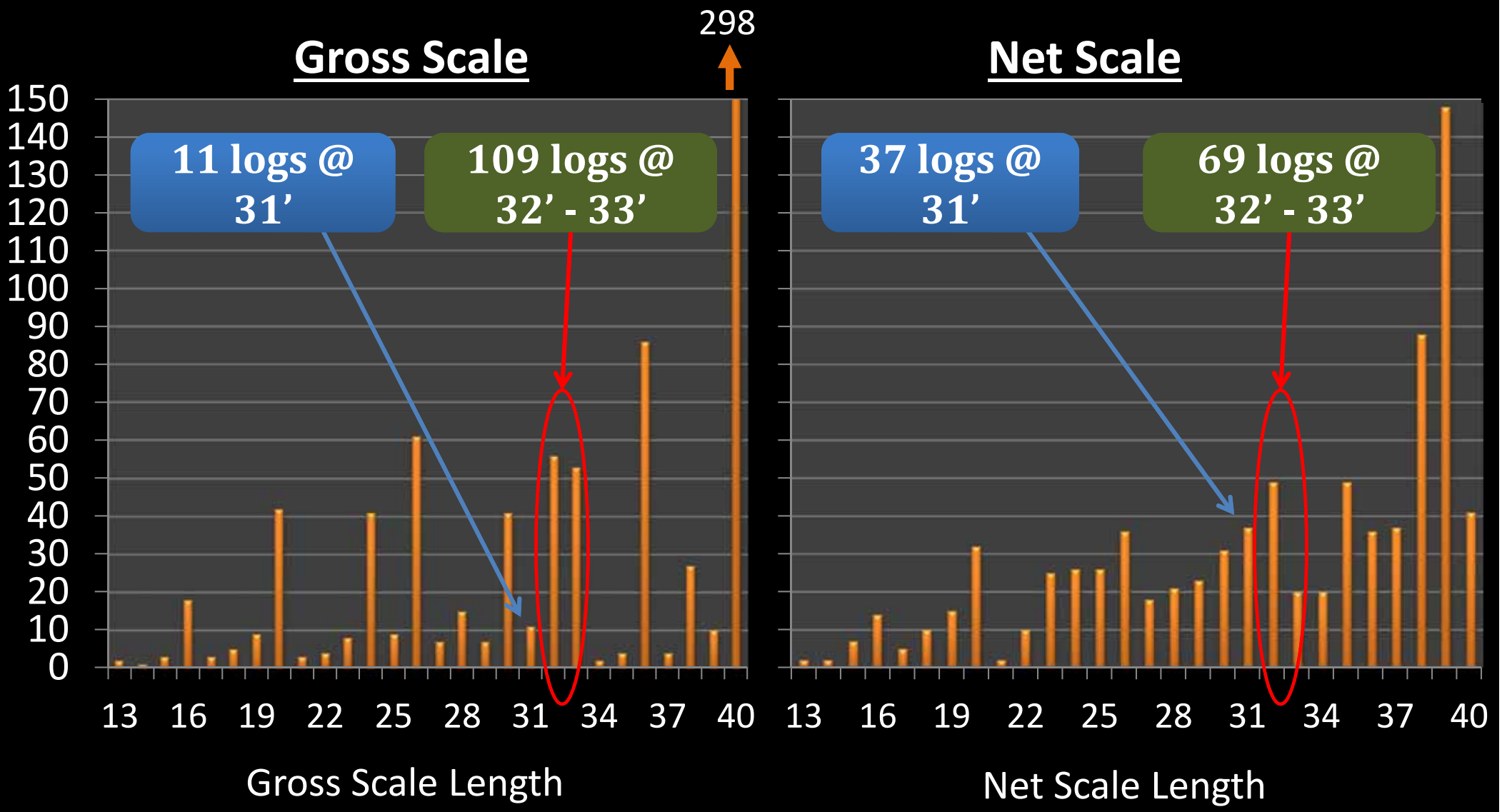
-15%

+18%

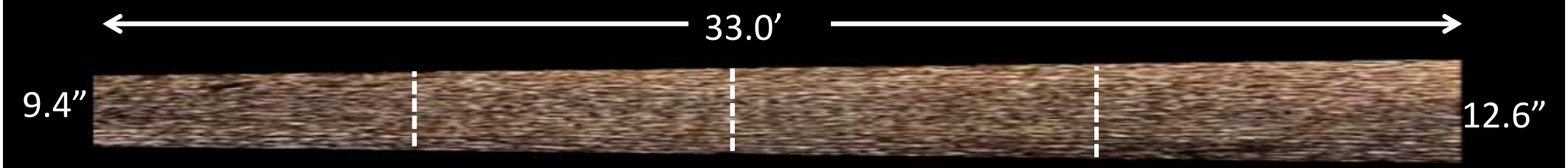
<1%

Scribner's length bias

Distribution of scaling lengths for 830 hemlock logs, 8"-11" Sort



Scribner's length bias
Can frustrate efficient use of wood fiber



The 32' scale length will yield four 99" blocks for 96" Studs

Scribner 90 bf x $470 = $42.30
Cubic 0.630 m^3 x $65 = $40.95

A mill cutting 92 5/8" PET studs would prefer a 31' scale length to yield four stud blocks without sending excessive wood to the chipper

Scribner 70 bf x $470 = $32.90
Cubic 0.611 m^3 x $65 = $39.72

31' scale length has 22% less Scribner volume, but only 3% less solid wood

A good measurement system:

is balanced to reward productive behavior and discourage "game playing"

With Scribner, "[t]here are many … games played and the rewards are due in part to the skill of the players, but a liberal dose of luck is also involved….

Whereas Scribner encourages these games, cubic will diminish their importance….

'What does your company want, employees who play the game well or employees with the ability to make rational decisions?'"

Thomas Snellgrove and Thomas Fahey, 1982

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1. Is Quantitative	✓	✓
2. Is Easy to Understand		✓
3. Encompasses both outputs and inputs		✓
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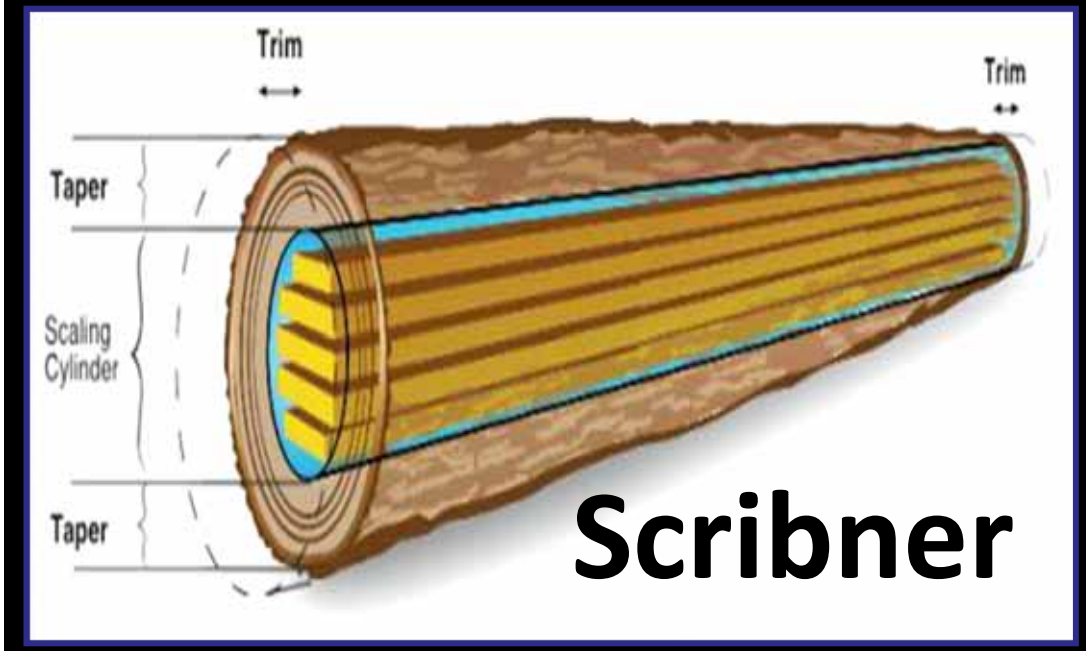
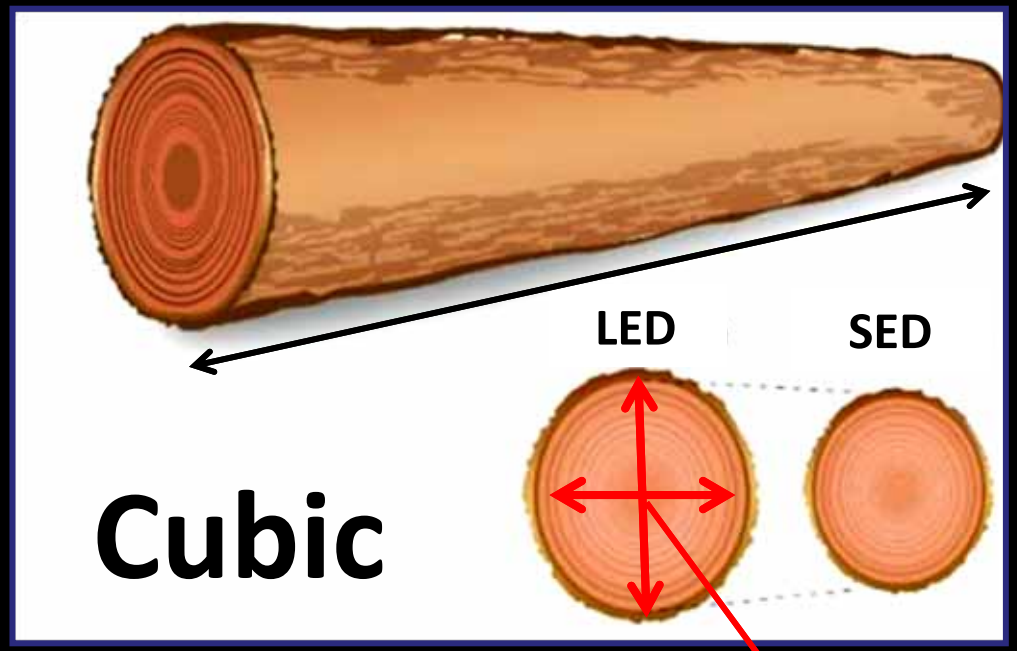
A good measurement system's:

benefits outweigh the costs of collection and analysis





Cubic scale requires one more measurement (LED)
Are benefits of Cubic worth the effort to change?

A good measurement system's:

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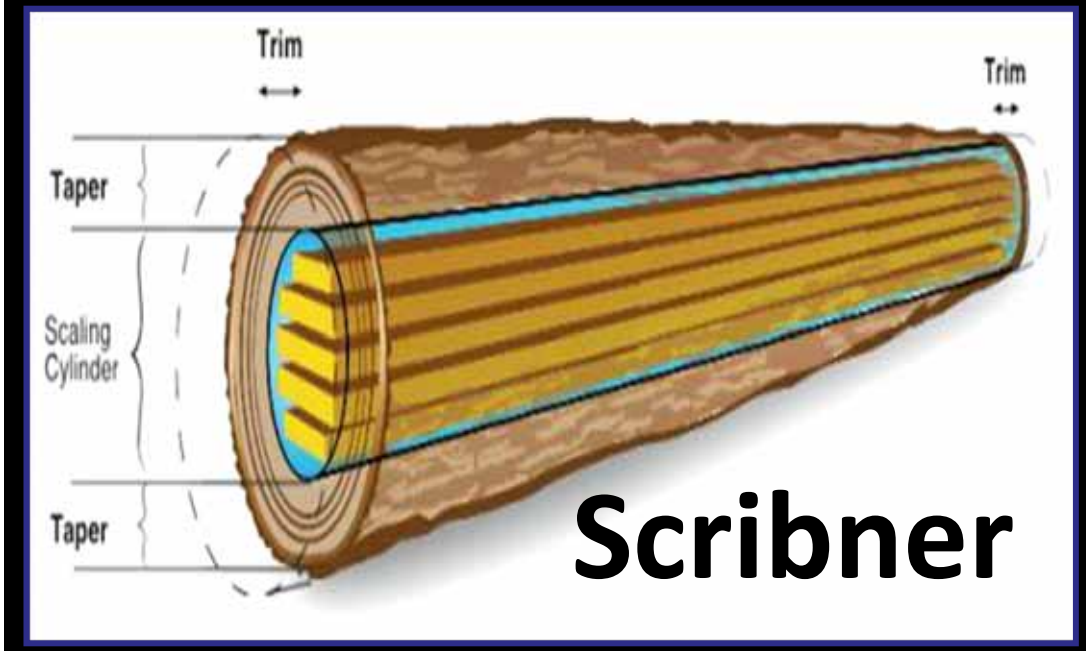

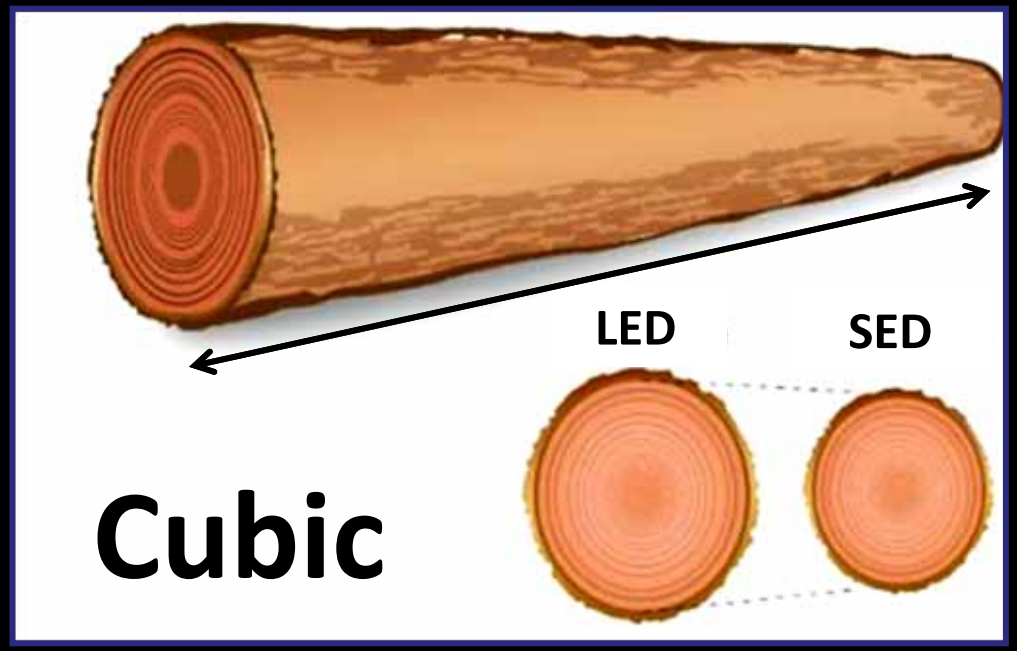

How informative are measurements in Scribner?

For logs ≤ 12” SED, Scribner’s volume rounding nullifies a high percentage of defect assessments

Length deduction (ft) with no impact on Scribner volume

Dia.	Length: 20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
4	12	13	14	0	1	2	3	4	5	6	7	8	9	10	11	12	13	0	1	2	3
5	5	6	7	8	0	1	2	3	4	5	6	7	8	0	1	2	3	4	5	6	7
6	7	0	1	2	3	4	5	6	7	0	1	2	0	1	2	3	0	1	2	3	4
7	4	5	0	1	2	3	4	5	0	1	2	3	0	1	2	3	4	0	1	2	3
8	1	2	3	4	5	0	1	2	3	4	0	1	0	1	2	0	1	2	3	0	1
9	1	2	1	0	1	2	3	0	1	2	3	4	0	0	1	2	3	0	1	2	0
10	1	2	0	1	0	1	2	0	1	2	0	1	0	0	1	2	0	1	2	0	1
11	1	0	1	0	1	2	0	1	0	1	0	1	0	0	1	0	1	0	1	0	1
12	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0

0’	1’ - 5’+	2’ - 5’+	3’ - 5’+	4’- 5’+	5’+
28%	72%	44%	35%	29%	15%

For logs ≤ 12” SED, Scribner’s volume rounding nullifies a high percentage of defect assessments

830 Hemlock Logs - 8”-11” Sort

Length Deduct	No. of Logs	Logs where length deduct made no difference	
		No. of Logs	Percent
None	252	-	-
1’	349	232	**66%**
2’	175	22	**13%**
3’+	54	3	**6%**
1’-3’+	578	257	**44%**
All	830		

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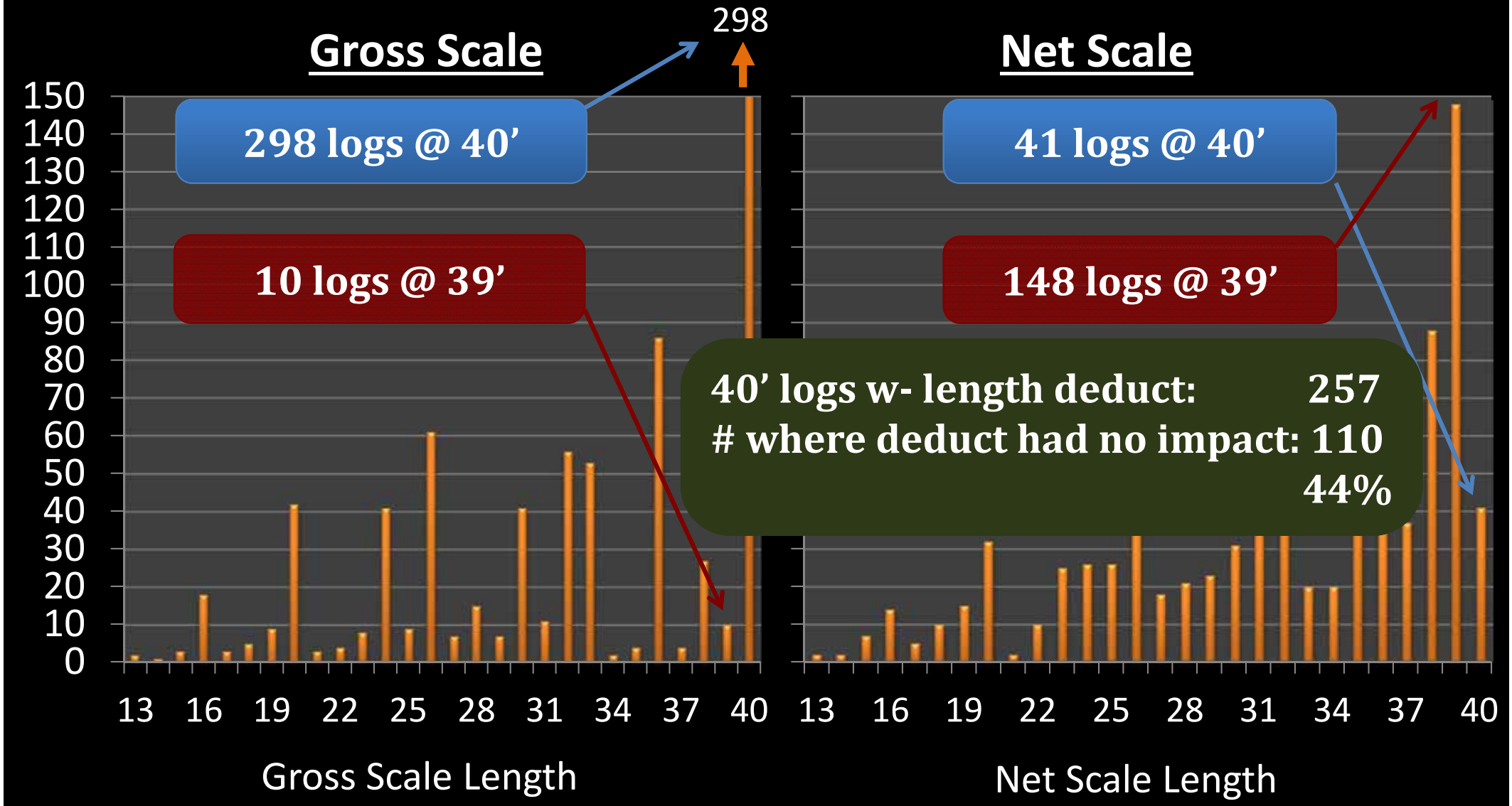
Distribution of scaling lengths for 830 hemlock logs, 8”-11” Sort



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We're on the road

What's keeping U.S. from getting there?