

TOP DIAMETERS FOR MESAVAGE AND GIRARD FORM CLASS VOLUME TABLES

Many people are under the impression that the Mesavage and Girard (1946) form class volume tables have a single fixed top diameter for all trees, although opinions on what that diameter might be differ widely. I have been asked many times to convert the tables to a 8 inch or 6 inch or some other fixed top diameter from the fixed top the individual thinks they are using now. But, the form class volume tables do not have a fixed top diameter. Top diameter varies by DBH, merchantable height, and form class. Using them as though there is a fixed top diameter will cause inaccurate volume estimates.

Introduction

Mesavage and Girard (1946) form class volume tables (M&G tables) are widely used and commonly accepted as standard volumes for sawtimber trees. Many inventory specifications call for form class volume tables and measurement of sawtimber and related products in 16 foot logs to a fixed top diameter inside or outside bark. Common fixed top diameters are 8 and 10 inches, with others such as 6 and 12 inches also being used depending on the tree species or product being estimated. But, specifying M&G tables and fixed top diameters is a contradiction. Top diameter in M&G tables depends on DBH, form class, and total number of logs. Nothing about the top diameters of any log is fixed. The top diameter of a particular log may actually be 8 or 10 or 12 inches, but it's entirely by accident, not design.

Explanation

The original publication is quite explicit about taper and log top diameters. The diameter inside bark of the first log, regardless of the total number of logs, is the form class, as a decimal, multiplied by tree DBH. Taper in logs above the first log in any tree, regardless of form class, is shown on page 7 of the original publication.

For example, consider a 14 inch DBH, 3 log tree with form class 78. The dib at the top of the first log is 10.9 inches (14×0.78). From the table the taper in the second log is 1.4 inches, so the second log top dib is 9.5 inches ($10.9 - 1.4$). Again, from the table the taper in the third log is 1.6 inches, so the third log top dib is 7.9 inches. An example of calculating the log top dib's is shown on page 2 of the original publication.

Table 1 below shows the M&G table dib at the top of the last log for some common DBH's and form classes 78, 80, and 82. These are the top diameters on which the table volumes are based. In particular, note that there is no consistent top diameter for the ultimate log. Top diameter decreases as number of logs increases for a given DBH, increases as DBH increases for a given merchantable height, and increases as form class increases for a given DBH and merchantable height. The range of top diameters within a form class is quite large.

R. G. Oderwald
Foresters Incorporated
August, 2003

The top dubs in Table 1 mean that when you call a tree height to a fixed top diameter, you and the M&G tables are thinking of two completely different trees. As one example, suppose you call 2 logs to a 10 inch top ob for a 16 inch DBH tree with form class 78. Using a 0.9 bark thickness ratio your tree is 2 logs to a 9 inch dib at the top of the second log. The tree the table sees is 2 logs to a 10.6 inch top dib, almost 2 inches dib bigger than the tree you are looking at. The table's tree has 180 board feet International. Your tree only has 157 board feet International. The difference is 23 board feet in just one tree.

Some form class table volume entries may exactly match fixed top diameter volumes. For example, in the form class 80 table the top dib is exactly 8 inches for 10 inch DBH, 1 log and for 12 inch DBH, 2 logs, and is close to 8 inches for several other tree sizes. However, these matches are coincidental rather than planned.

In the same fashion, some form class volume table entries will be less than actual volume. In the form class 80 table the top diameter for a 12 inch DBH, 3 log tree is 6.8 inches. Volume based on this top diameter will be less than if 3 logs were measured to an 8 inch fixed top diameter.

Summary

The form class volume tables are not based on any single fixed top diameter. Top diameter differs by DBH, logs, and form class. Most top diameters in the tables for the commonly used form classes, 78 to 82, are larger than the typical top diameters specified for inventories, so that volume will be most often overestimated. Smaller fixed top diameters, such as 6 and 7 inches that are often used for chip-and-saw logs, cause more overestimate in volume than larger fixed top diameters.

Changing the form class also changes the implicit top diameter. A 12 inch DBH, 2 log tree has a top diameter of 7.8 inches with form class 78, an 8 inch top diameter with form class 80, and an 8.2 inch top diameter with form class 82. Therefore, increasing the form class to accommodate trees with less taper may actually increase the overestimate of volume when a fixed top diameter is used to determine merchantable length.

The worry people have of getting the correct form class is misplaced. The problem isn't the right form class, the problem is top diameter. You could get the exactly correct form class for every tree in the woods and still get the wrong volume.

M&G form class volume tables served a purpose when we had no computers or modern volume and taper equations. We can do better now, and we should.

Table 1: M&G table top diameter inside bark of the last log by DBH and merchantable height for form classes 78, 80, and 82.

Form Class 78

DBH	Number of 16 foot logs					
	1	2	3	4	5	6
	Dib at top of last log (inches)					
10	7.8	6.4	5.2			
12	9.4	7.8	6.6	5.0		
14	10.9	9.2	7.9	6.2		
16	12.5	10.6	9.3	7.6		
18	14.0	12.0	10.6	8.8		
20	15.6	13.5	12.0	10.0	7.8	
22	17.2	15.0	13.4	11.3	9.2	
24	18.7	16.4	14.7	12.4	10.3	
26	20.3	17.9	16.1	13.8	11.6	
28	21.8	19.3	17.4	15.0	12.8	9.8
30	23.4	20.8	18.8	16.2	14.0	11.3
32	25.0	22.3	20.3	17.7	15.1	12.7
34	26.5	23.7	21.7	18.9	16.3	13.9
36	28.1	25.3	23.2	20.3	17.7	15.1
38	29.6	26.7	24.7	21.7	19.1	16.2
40	31.2	28.3	26.2	23.2	20.3	17.3

Form Class 80

Number of 16 foot logs						
DBH	1	2	3	4	5	6
	Dib at top of last log (inches)					
10	8.0	6.6	5.4			
12	9.6	8.0	6.8	5.2		
14	11.2	9.5	8.2	6.5		
16	12.8	10.9	9.6	7.9		
18	14.4	12.4	11.0	9.2		
20	16.0	13.9	12.4	10.4	8.2	
22	17.6	15.4	13.8	11.7	9.6	
24	19.2	16.9	15.2	12.9	10.8	
26	20.8	18.4	16.6	14.3	12.1	
28	22.4	19.9	18.0	15.6	13.4	10.4
30	24.0	21.4	19.4	16.8	14.6	11.9
32	25.6	22.9	20.9	18.3	15.7	13.3
34	27.2	24.4	22.4	19.6	17.0	14.6
36	28.8	26.0	23.9	21.0	18.4	15.8
38	30.4	27.5	25.5	22.5	19.9	17.0
40	32.0	29.1	27.0	24.0	21.1	18.1

Form Class 82

Number of 16 foot logs						
DBH	1	2	3	4	5	6
	Dib at top of last log (inches)					
10	8.2	6.8	5.6			
12	9.8	8.2	7.0	5.4		
14	11.5	9.8	8.5	6.8		
16	13.1	11.2	9.9	8.2		
18	14.8	12.8	11.4	9.6		
20	16.4	14.3	12.8	10.8	8.6	
22	18.0	15.8	14.2	12.1	10.0	
24	19.7	17.4	15.7	13.4	11.3	
26	21.3	18.9	17.1	14.8	12.6	
28	23.0	20.5	18.6	16.2	14.0	11.0
30	24.6	22.0	20.0	17.4	15.2	12.5
32	26.2	23.5	21.5	18.9	16.3	13.9
34	27.9	25.1	23.1	20.3	17.7	15.3
36	29.5	26.7	24.6	21.7	19.1	16.5
38	31.2	28.3	26.3	23.3	20.7	17.8
40	32.8	29.9	27.8	24.8	21.9	18.9