APPENDIX 10 -- CULL TABLES, SCALING DEDUCTION METHODS, SLOPE CORRECTION TABLES & MORE

PERCENT OF CUBIC-FOOT CULL VOLUME FOR *ALL TREES* BY 4-FT SECTIONS & LOCATION IN THE TREE									
LENGTH (FT)	**1ST**	**2ND**	**3RD**	**4TH**	**5TH**	**6TH**	**7TH**	**8TH**	**9TH**
8	57	43							
12	42	32	26						
16	30	26	23	21					
20	26	23	21	19	11				
24	24	21	18	17	10	10			
28	21	19	17	16	10	9	8		
32	20	18	16	14	10	8	7	7	
36	19	16	14	13	9	8	8	7	6
40	17	15	13	12	9	8	7	7	6
44	16	14	12	11	9	7	7	7	6
48	15	13	12	10	8	7	7	6	6
52	14	12	11	9	8	7	6	6	6
56	13	11	10	9	8	6	6	6	6
60	12	11	10	9	7	6	6	6	6
64	11	10	9	9	7	6	6	6	5
68	10	10	9	8	6	6	6	5	5
72	10	9	8	8	6	6	6	5	5
	10TH	**11TH**	**12TH**	**13TH**	**14TH**	**15TH**	**16TH**	**17TH**	**18TH**
40	6								
44	6	5							
48	6	5	5						
52	6	5	5	5					
56	6	5	5	5	4				
60	5	5	5	5	4	4			
64	5	5	5	5	4	4	4		
68	5	5	5	4	4	4	4	4	
72	5	4	4	4	4	4	4	4	4

PERCENT OF BOARD-FOOT CULL OF *HARDWOOD SAWTIMBER* BY 4-FT SECTIONS & LOCATION IN THE TREE								
LOG (FT)	**1ST**	**2ND**	**3RD**	**4TH**	**5TH**	**6TH**	**7TH**	**8TH**
1 (16)	29	26	24	21				
1-1/2 (24)	19	18	16	16	16	15		
2 (32)	15	14	13	13	12	12	11	10
2-1/2 (40)	12	12	11	11	10	10	9	9
3 (48)	12	10	10	9	9	9	8	7
3-1/2 (56)	10	10	9	9	9	8	8	7
4 (64)	9	9	9	8	8	7	7	7
	9TH	**10TH**	**11TH**	**12TH**	**13TH**	**14TH**	**15TH**	**16TH**
2-1/2 (40)	8	8						
3 (48)	7	7	6	5				
3-1/2 (56)	7	6	5	5	4	3		
4 (64)	6	6	5	5	4	4	3	3

PERCENT OF BOARD-FOOT CULL OF *SOFTWOOD SAWTIMBER* BY 4-FT SECTIONS & LOCATION IN THE TREE								
LOG (FT)	**1ST**	**2ND**	**3RD**	**4TH**	**5TH**	**6TH**	**7TH**	**8TH**
1 (16)	33	27	21	19				
1-1/2 (24)	26	20	16	15	12	11		
2 (32)	21	17	14	12	10	9	9	8
2-1/2 (40)	19	15	12	10	9	8	7	7
3 (48)	16	13	11	10	8	7	7	6
3-1/2 (56)	13	12	10	9	7	7	6	6
4 (64)	10	9	9	8	7	7	6	6
	9TH	**10TH**	**11TH**	**12TH**	**13TH**	**14TH**	**15TH**	**16TH**
2-1/2 (40)	7	6						
3 (48)	6	6	5	5				
3-1/2 (56)	6	5	5	5	5	4		
4 (64)	6	5	5	5	5	4	4	4

METHODS OF DETERMINING SCALING DEDUCTION

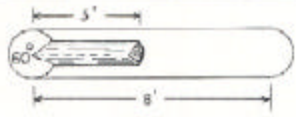
(Examples based on an 8-foot log with 20-inch scaling diameter)

If section of bole is affected, deduct percent of log length affected.

Example: $\frac{2}{8}$ = 25 percent cull

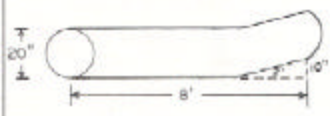
If sector is affected, multiply percent of circle times percent of length.

Example: $\frac{60^0}{360^0} \times \frac{3}{8}$ = 6% cull



For a crook, multiply proportion of diameter displaced times proportion of log length affected by crook.*

Example: $\frac{10}{20} \times \frac{2}{8}$ = 12% b.f. cull

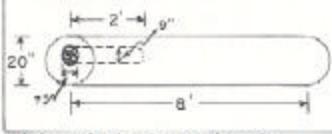


For a sweep, determine sweep departure and subtract 1" for 8' logs or 2" for 16' logs. Divide by log diameter.

Example: $\frac{8-1}{20}$ = 35% b.f. cull**

For interior cull, square out interior cull as a percent of total volume of the section. For bd. ft. cull, add 1" to width and to thickness; for cu. ft. cull, use actual dimensions of rot. For bd. ft. cull divide width and thickness by the scaling diameter (ave. d.i.b., small end) minus 1; for cu. ft. cull, divide by scaling diameter. Multiply fractions by percent of log affected.

Example: $\frac{8 \times 10}{(20-1)^2} \times \frac{2}{8}$ = 6% cubic-foot cull



* No reduction of cubic-foot volume will be made.

** If a straight line between A and B falls outside the bark, the affected section is over 50% cull in board feet.

SLOPE CORRECTION TABLE									
	Chaining Distances								
% SLOPE	120.0	100.0	98.4	60.0	52.7	49.0	37.2	34.6	24.0
1 - 3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
6	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.0
8	0.4	0.3	0.3	0.2	0.2	0.2	0.1	0.1	0.1
10	0.6	0.5	0.5	0.3	0.3	0.2	0.2	0.2	0.1
12	0.9	0.7	0.7	0.4	0.4	0.4	0.3	0.2	0.2
14	1.2	1.0	1.0	0.6	0.5	0.5	0.4	0.3	0.2
16	1.5	1.3	1.2	0.8	0.7	0.6	0.5	0.4	0.3
18	1.9	1.6	1.6	1.0	0.8	0.8	0.6	0.6	0.4
20	2.4	2.0	1.9	1.2	1.0	1.0	0.7	0.7	0.5
22	2.9	2.4	2.4	1.4	1.3	1.2	0.9	0.8	0.6
24	3.4	2.8	2.8	1.7	1.5	1.4	1.1	1.0	0.7
26	4.0	3.3	3.3	2.0	1.7	1.6	1.2	1.1	0.8
28	4.6	3.8	3.8	2.3	2.0	1.9	1.4	1.3	0.9
30	5.3	4.4	4.3	2.6	2.3	2.2	1.6	1.5	1.1
32	6.0	5.0	4.9	3.0	2.6	2.5	1.9	1.7	1.2
34	6.7	5.6	5.5	3.4	3.0	2.8	2.1	1.9	1.3
36	7.5	6.3	6.2	3.8	3.3	3.1	2.3	2.2	1.5
38	8.4	7.0	6.9	4.2	3.7	3.4	2.6	2.4	1.7
40	9.2	7.7	7.6	4.6	4.1	3.8	2.9	2.7	1.8
42	10.2	8.5	8.3	5.1	4.5	4.1	3.1	2.9	2.0
44	11.1	9.3	9.1	5.6	4.9	4.5	3.4	3.2	2.2
46	12.1	10.1	9.9	6.0	5.3	4.9	3.7	3.5	2.4
48	13.1	10.9	10.7	6.6	5.8	5.4	4.1	3.8	2.6
50	14.2	11.8	11.6	7.1	6.2	5.8	4.4	4.1	2.8
52	15.3	12.7	12.5	7.6	6.7	6.2	4.7	4.4	3.1
54	16.4	13.7	13.4	8.2	7.2	6.7	5.1	4.7	3.3
56	17.5	14.6	14.4	8.8	7.7	7.2	5.4	5.1	3.5
58	18.7	15.6	15.4	9.4	8.2	7.6	5.8	5.4	3.7
60	19.9	16.6	16.4	10.0	8.8	8.1	6.2	5.8	4.0
62	21.2	17.7	17.4	10.6	9.3	8.7	6.6	6.1	4.2
64	22.5	18.7	18.4	11.2	9.9	9.2	7.0	6.5	4.5
66	23.8	19.8	19.5	11.9	10.4	9.7	7.4	6.9	4.8
68	25.1	20.9	20.6	12.6	11.0	10.3	7.8	7.2	5.0
70	26.5	22.1	21.7	13.2	11.6	10.8	8.2	7.6	5.3
72	27.9	23.2	22.8	13.9	12.2	11.4	8.6	8.0	5.6
74	29.3	24.4	24.0	14.6	12.9	12.0	9.1	8.4	5.9
76	30.7	25.6	25.2	15.4	13.5	12.5	9.5	8.9	6.1
78	32.2	26.8	26.4	16.1	14.1	13.1	10.0	9.3	6.4
80	33.7	28.1	27.6	16.8	14.8	13.7	10.4	9.7	6.7
82	35.2	29.3	28.9	17.6	15.5	14.4	10.9	10.1	7.0
84	36.7	30.6	30.1	18.4	16.1	15.0	11.4	10.6	7.3
86	38.3	31.9	31.4	19.1	16.8	15.6	11.7	11.0	7.7
88	39.8	33.2	32.7	19.9	17.5	16.3	12.4	11.5	8.0
90	41.4	34.5	34.0	20.7	18.2	16.9	12.8	12.0	8.3
92	43.1	35.9	35.3	21.5	18.9	17.6	13.3	12.4	8.6
94	44.7	37.2	36.6	22.3	19.6	18.2	13.9	12.9	8.9
96	46.3	38.6	38.0	23.2	20.4	18.9	14.4	13.4	9.3
98	48.0	40.0	39.4	24.0	21.1	19.6	14.9	13.8	9.6
100	49.7	41.4	40.8	24.9	21.8	20.3	15.4	14.3	9.9

HOW TO DETERMINE THE LENGTH OF A SIDE WHEN THE INTERIOR ANGLE IS KNOWN (SOLVING FOR RIGHT TRIANGLES)

Many times it will be easier to measure along the edge of a potential contrasting condition than across. The following steps and table can be used to determine when the width across an interior corner angle becomes 120 ft wide. (See Figures 5 and 6 on page 48 and 49.)

1. Determine interior angle of corner.
2. Refer to table below to find limiting distance along edge of condition.

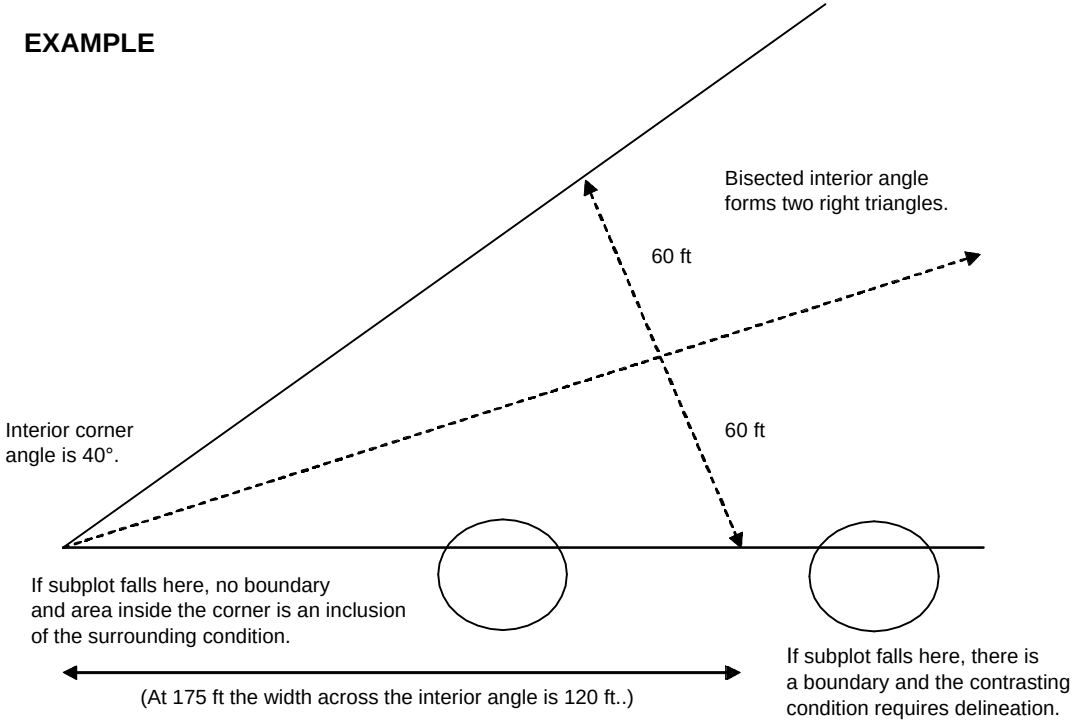
Interior Angle of Corner	Limiting Distance (FT)		Interior Angle of Corner	Limiting Distance (FT)
88	86.4		58	123.8
86	88.0		56	127.8
84	89.7		54	132.2
82	91.5		52	136.9
80	93.3		50	142.0
78	95.3		48	147.5
76	97.5		46	153.6
74	99.7		44	160.2
72	102.1		42	167.4
70	104.6		40	175.4
68	107.3		38	184.3
66	110.2		36	194.2
64	113.2		34	205.2
62	116.5		32	217.7
60	120.0		30	231.8

The following formula was used to create the preceding table.

Liminting Distance = 60 / SIN (Interior Angle x .5)

See example on next page.

EXAMPLE


Bisected interior angle
forms two right triangles.
60 ft
60 ft
Interior corner
angle is 40°.
If subplot falls here, no boundary
and area inside the corner is an inclusion
of the surrounding condition.
If subplot falls here, there is
a boundary and the contrasting
condition requires delineation.
(At 175 ft the width across the interior angle is 120 ft..)

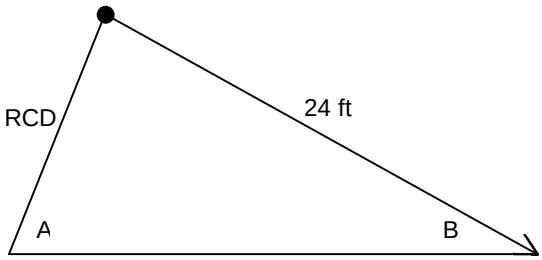
HOW TO DELENIATE BOUNDARIES IF SUBPLOT CENTER IS INACCESSIBLE DUE TO DENIED, HAZARDOUS CONDITIONS OR WATER – Occasionally when chaining to a subplot, the subplot center is inaccessible. By applying the Law of Sines it is possible to accurately delineate the left and right boundary azimuths.

Steps to Determine Left and Right Boundary Azimuths:

1. Chain to the edge of inaccessible area.
2. Determine the remaining chain distance (RCD).
3. Determine the edge azimuth of inaccessible area.
4. Calculate the difference between the chaining azimuth and the edge azimuth of the inaccessible area. Use the acute angle (A).
5. From the table find this angle (A) and note the associated SIN value.
6. Divide the SIN value by 24.
7. Multiple the value from Step 6 by the remaining chain distance (RCD).
8. Find the nearest SIN value in the table and note the associated angle (B).
9. Subtract or add this angle (B) as appropriate from the edge azimuth of the inaccessible area. This will yield the left and right boundaries for the contrasting condition. Be careful that these angles are recorded properly.

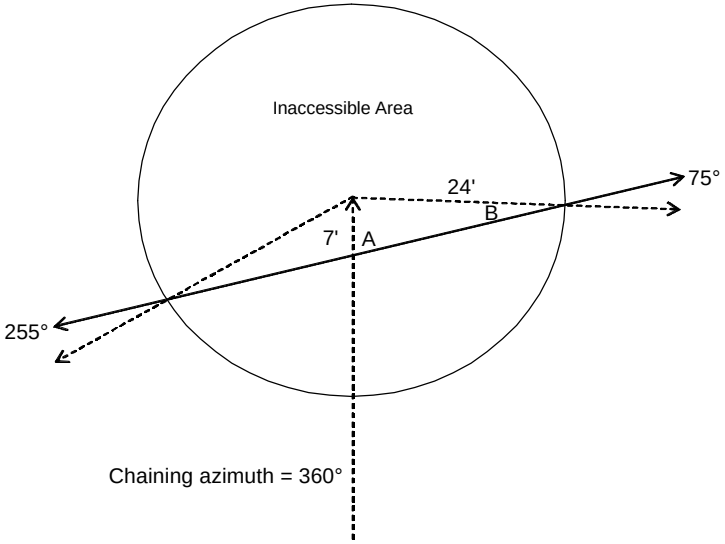
The above steps and table on the next page are derived from the following: Since 2 sides and an angle are known, the following formula is used to solve for angle B as illustrated below:

SIN A / 24 = SIN B / RCD



Angle	SIN	Angle	SIN	Angle	SIN
1	0.0175	**31**	0.5150	**61**	0.8746
2	0.0349	**32**	0.5299	**62**	0.8829
3	0.0523	**33**	0.5446	**63**	0.8910
4	0.0698	**34**	0.5592	**64**	0.8988
5	0.0872	**35**	0.5736	**65**	0.9063
6	0.1045	**36**	0.5878	**66**	0.9135
7	0.1219	**37**	0.6018	**67**	0.9205
8	0.1392	**38**	0.6157	**68**	0.9272
9	0.1564	**39**	0.6293	**69**	0.9336
10	0.1736	**40**	0.6428	**70**	0.9397
11	0.1908	**41**	0.6561	**71**	0.9455
12	0.2079	**42**	0.6691	**72**	0.9511
13	0.2250	**43**	0.6820	**73**	0.9563
14	0.2419	**44**	0.6947	**74**	0.9613
15	0.2588	**45**	0.7071	**75**	0.9659
16	0.2756	**46**	0.7193	**76**	0.9703
17	0.2924	**47**	0.7314	**77**	0.9744
18	0.3090	**48**	0.7431	**78**	0.9781
19	0.3256	**49**	0.7547	**79**	0.9816
20	0.3420	**50**	0.7660	**80**	0.9848
21	0.3584	**51**	0.7771	**81**	0.9877
22	0.3746	**52**	0.7880	**82**	0.9903
23	0.3907	**53**	0.7986	**83**	0.9925
24	0.4067	**54**	0.8090	**84**	0.9945
25	0.4226	**55**	0.8192	**85**	0.9962
26	0.4384	**56**	0.8290	**86**	0.9976
27	0.4540	**57**	0.8387	**87**	0.9986
28	0.4695	**58**	0.8480	**88**	0.9994
29	0.4848	**59**	0.8572	**89**	0.9998
30	0.5000	**60**	0.8660	**90**	1.0000

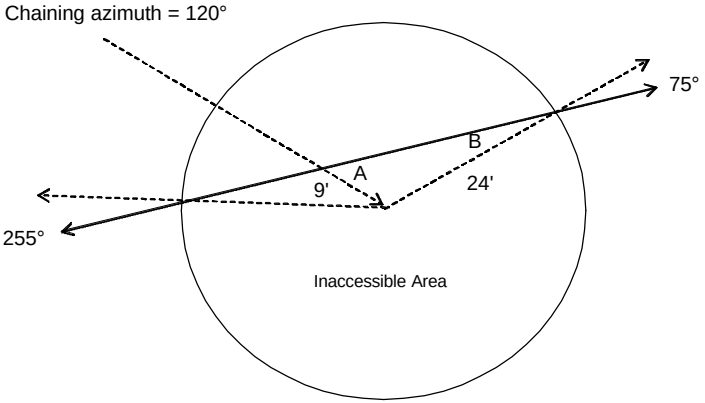
Example 1 (How to Apply Steps and Table)



RCD = 7 ft
Edge Azimuth = 75° or 255°
A = 75° or (360 or 000 - 75)
SIN 75° = 0.9569
0.9569 / 24 = .0398
.0398 x 7 = .2786
SIN .2786 = 16°

Left azimuth = 75 + 16 = 91°
Right azimuth = 255 - 16 = 239°

Example 2



RCD = 9 ft
Edge Azimuth = 75° or 255°
A = 45° or (120 - 75)
SIN 45° = 0.7071
0.7071 / 24 = .0294
.0294 x 9 = .2646
SIN .2646 = 15°

Left azimuth = 255 + 15 = 270°
Right azimuth = 75 - 15 = 60°