Net Factoring 2

2.1 Net Factoring Process

1. In conjunction with the end use sorts, standard log lengths and cruiser call grading rules, determine the applicable log lengths for each tree to the nearest whole metre.

2. Using measurements and procedure-based deductions, calculate the net volume expressed as a net factor for each log section.

3. Loss indicators that extend below ground level are considered in the net factoring process.

   For example, a frost crack that extends from minus 0.5 to plus 1.5 is calculated as a 2.0 metre frost crack. The loss is applied to the first log. Similarly a root rot conk present on the ground is applied to the first log.

4. Assign a net factor to each log. If the log has no measurable sound wood loss then the net factor is 100%. Record the net factor as two dashes (--).

5. Note that direct volume "measurement" deductions (net factoring) by log are made where the decay or missing wood is both visible and physically measurable. For example:

   - Butt rot,
   - Missing wood,
   - Scars,
   - Saprot.

   Where this is not possible, procedure based deductions are applied. For example:

   - Conk,
   - Blind conk,
   - Frost cracks,
   - Rotten branches,
   - Root rot,
   - Rot in forks or crooks,
   - Rot in broken tops,
   - Soundings.

2.2 Net Factoring Deductions

Net factoring deductions for this manual will normally be expressed as length deductions. The net log length expressed as a percent of the gross log length represents the net factor in percent. For example, an 8.0 metre log may have a 0.8 m deduction due to rot. The net factor is 90% because 10% of the log length is missing (7.2/8.0) x 100 = 90%.

Some situations may require lookup tables or log volume calculations.

Logs are considered cylinders for log volume calculations and decayed portions may be rectangular (such as scars), cylindrical (such as conks) or conical (such as butt rot). The following conventions and formulas shown in Table 2 will be used in the calculations.

Diameter: length of a straight line passing through the centre of a circle.

Radius: line extending from the centre of a circle to the circumference (½ diameter).

L = length; W = width; D = depth; R = radius.

Table 2 Formula for Calculating Volume

Shape	Formula
Cylinder	Volume = $\pi R^2 * L$
Cone	Volume = $(1/3) \pi R^2 * L$
Rectangular solid	Volume = L * W * D
Units must be consistent (all cm or all m).	

2.2.1.2 Applying Deduction Rules

Table 3 Summary of Procedures for Determining Net Factor for Loss Indicators

Defect	Form	Method	Deduction Area	% Sound or Length Deduction Area	Grade
Heart Rot Conk	Cylindrical	Procedure	2 m above conk 4 m below conk	50%	Y
Blind Conk	Cylindrical	Procedure	4 m above conk 6 m below conk	50%	Y
Rotten branch	Cylindrical	Procedure	1 m above 1 m below	1.0 metre	Z
Butt rot/Cat face	Conical	Calculate	extent of scar	calculated	assigned*
Root rot (fruiting body on ground)	Conical	Procedure	3 m	0.6 metres	assigned*
Sounding	Conical	Procedure	0.8 m length deduction	calculated	assigned*
Scar	Rectangular	Calculate	extent of scar	calculated	assigned*
Frost crack	Other	Procedure	extent of frost crack	0.1 m per lineal metre of frost crack	assigned*
Fork	Other	Procedure	if decay present: 1 m below	0.5 metre	Z
Crook	Other	Procedure	if decay present: 1 m below	0.5 metre	Z
Dead top	Other	Calculate	live crown to top of tree	Net Factor = 85% if can't be measured	assigned*
Broken top	Other	Procedure	broken off portion if decay present 1.0 m below break	00 1.0 metre	N assigned*
Direct Observation	Other	Procedure	various	calculated	assigned*

* Assigned by cruiser in the field

* * d = diameter of sound wood/D = outside diameter log

Table 3 Notes

Calculated = net factor calculated based on formulae in this manual.
Assigned = Grade assigned from grade consideration based on surface characteristics and decay percentage.
Table = Reference tables in this manual.
Z-Grade = non-recoverable fibre.

2.3 Deduction Procedures for Loss Indicators

2.3.1 Heart Rot Conk

The standard is that conk rot extends 2 m above the conk and 4 m below it. This creates a 6 m pulp log (Y grade) with a net factor of 3 metres or 50%.

For example, a tree with 22 m of sawlog quality and a conk at 12 m could be pencil bucked as a sawlog for 8 m, pulp (Y grade) for 6 m (net factor 50%), then sawlog for 8 m.

Table 4 Deduction Procedure for Heart Rot Conk

Form	Cylindrical
Method	Procedure
Deduction area	2 m above conk; 4 m below
% Sound of deduction area (net factor)	50% or 3 metre length deduction
Grade	Y

Formula

Net Factor = (Net Log Length/Log Length) x 100%

For example (6.0 – 3.0)/6.0 x 100 = 50%

For multiple conks, decay is assumed to extend 2 m above the top conk and 4 m below the lowest conk. The connected length is given a net factor of 50% and a grade of Y.

Do not overlap conk and blind conk deductions as they are not cumulative. The net factor can be less than 50% if there are other indicators associated with a conk or blind conk segment.

> Fomitopsis pinicola is considered a heart rot for this procedure when it is on live cambium. (e.g., not on a dead tree or a dead portion of the tree). See the *Cruising Manual* Appendices for descriptions of the heart rot conks.

2.3.2 Root Rot

All root rots are assumed to be conical in nature. Unless otherwise observed, the standard procedure is that the cone of rot extends 3 m from the ground and that the ratio of the diameter of the rot to the diameter of the butt is 75% (¾).

The length deduction for the 3 metre section is 0.6 metre. If the fruiting body is located on the stem, then the butt rot length will be based on a cone that extends 3 metres above the highest fruiting body and the base of the cone will be a ¾ ratio.

Table 5 Deduction Procedure for Root Rot

Form	Conical
Method	Standard
Deduction area	0 - 3 m
Length deduction	0.6 m (if fruiting body is on the ground)
Grade	Assigned

Formula

Net Factor = (Net Log Length)/Log Length * 100%

EXAMPLE

Log length: 8 m; Rot extends: 3 m

Net Factor = (8 - 0.6) / 8 x 100

= 7.4 / 8 x 100

= 93 %

Figure 2.1 Example of Net Factor Calculation for Root Rot on the Ground.

If Schweintizii butt rot is encountered the net factoring process will apply the loss as a root rot [0.6 metre length deduction].

EXAMPLE

Fruiting body 3 m up the stem, therefore cone of rot extends 6 m up the stem.

Log length = 8 m, ¾ ratio conical rot extends 6 m, DBH: 100 cm

Deduction = $(3/4)^2$ x 6m/3

= 1.1 m

Net Factor = (8m – 1.1m)/8m x 100 %

= **86 %**

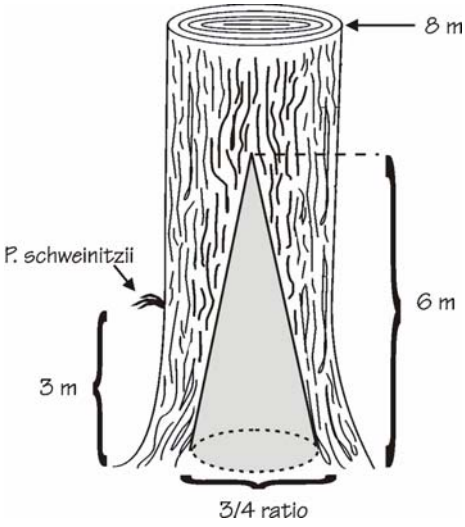

Figure 2.2 Example of Net Factor Calculation for Root Rot on the Tree.

2.3.3 Blind Conk

Coastal zone: typically the cambium is collapsed.

Table 6 Deduction Procedure for Blind Conk

Form	Cylindrical
Method	Procedure
Deduction area	4 m above conk; 6 m below
% Sound of deduction area (net factor)	50% or a 5 metre length deduction.
Grade	Y

Formula

Net Factor = (Net Log Length/Log Length) x 100

For the example below: (11 – 5)/11 x 100% = 54%

EXAMPLE

Log length = 11 m, blind conk at 7 m

Net factor = (11 m - 5 m)/11 m x 100% = 54 %

2.3.4 Frost Crack

Table 7 Deduction Procedure for Frost Crack

Form	Other.
Method	Procedure.
Deduction area	Log.
% Sound of deduction area (net factor)	0.1 metre deduction for each 1 m of frost crack in log.
Grade	Assigned.

Frost crack(s) that run across the grain of the log may result in a loss of merchantable volume and lower sort and/or grade.

Formula

Net Factor = (Net Log Length/Log Length) x 100%

For the example below: (11.0 – 1.4)/11.0 x 100% = 87%

EXAMPLE

Log length: 11 m;

Two frost cracks are located as follows:

6 m long (from 0 m to 6 m)
8 m long (from 3 m to 11 m)

Deduction = 0.1*(6m+8m) = 1.4 m

Net Factor = (11.0 – 1.4)/11.0 x 100 %

Net Factor = 87%

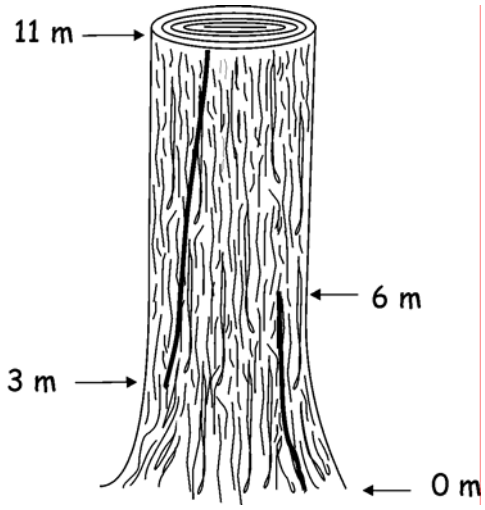

Figure 2.3 Example of Net Factor Calculation for Frost Cracks.

2.3.5 Scar

Table 8 Deduction Procedure for Scar

Form	Rectangular
Method	Calculate
Deduction area	Extent of scar
% Sound of deduction area (net factor)	Calculated
Grade	Assigned

Procedure #1 - When depth of rot can be measured and expressed as a rectangle.

For example, butt scars. Note that this is one procedure that uses volume as a deduction rather than length.

Formula

Net Factor = (Net volume of Log)/(Gross Volume of Log) * 100%

For the example below: (8.42/8.64) x 100% = 97%

Assume the scar is rectangular:

Decay volume = length * width * depth

Assume the log is cylindrical (diameter at DBH for butt logs, midpoint diameter for other logs):

Log volume = π * radius^2 * length

A net factor less than 95% is rare for a scar.

EXAMPLE
Log length: 11 m; diameter: 100 cm scar: length 11 m, width 20 cm, depth 10 cm 1. Volume of Decay = L * W * D (volume of rectangle) = 11 m * 0.2 m * 0.1 m = 0.22 m^3 2. Volume of Log = πR^2 L (volume of cylinder) = π * $(0.5\ m)^2$ * 11 m = 3.14 * 0.25 m^2 * 11 m = 8.64 m^3 3. Net Factor = (8.64-0.22)/8.64 * 100% = 8.42/8.64 * 100% = 97.454 - closer to 97%

Procedure #2 - Rot is visible but cannot be easily converted to a rectangular form or cannot easily be measured. This is a length deduction rather than the previous volume deduction.

Formula

Net Factor = (Net Log Length/Log Length) x 100%

For the example below: (12.7/13.0) x 100% = 98%

1. Estimate width and measured length of scar on log.

2. Calculate circumference of log at the scar (π x D).

3. Calculate "length" deduction = 1/2 (width of scar/circumference of log) x scar length.

4. Net Factor = (net log length/original log length) x 100.

EXAMPLE

Log length: 13 m; diameter: 100 cm
scar: length 11 m, width 20 cm, depth pie shape to pith

1. Circumference = π x D = 314 cm

2. Width of scar = 20 cm

3. Length deduction = 1/2 (20/314) = .03

   Length of scar = 11 m, .03 x 11 = .3 m

4. Net Factor = (12.7/13) x 100 = 98%

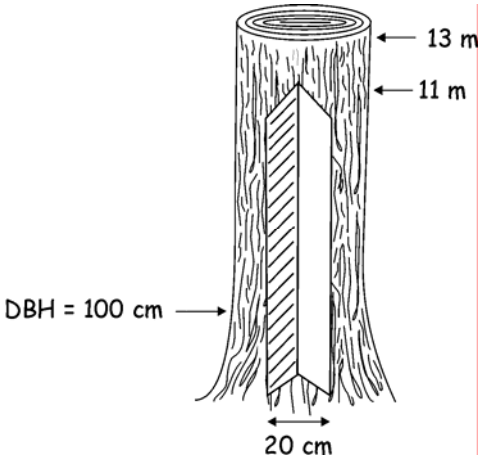

Figure 2.4 Examples of a Net Factor Calculation for Scars with Known Depth.

1. Estimate width and measure length of scar on log.

2. Calculate circumference of log at the scar (π * D).

3. Calculate "Length" deduction = ½ (width of scar/circumference of log) *scar length.

4. Net Factor = (volume of log-decay volume)/volume of log * 100%.

2.3.6 Butt Rot/Cat Face

Cat face is normally a "dry side" without rot. It is usually net factored the same as a scar. If the cat face is rotten then it is treated as butt rot.

Table 9 – Deduction Procedure for Butt Rots

Form	Cylindrical/Conical
Method	Calculate
Deduction area	Extent of Scar
% Sound of deduction area (net factor)	Calculated
Grade	Assigned

There are three methods of dealing with this form of internal decay:

Procedure #1 - Cylindrical Defect of Known Length

Formula

Net Factor = (Net Log Length/Log Length) x 100%

For the example below: (7.3/13) x 100% = 56%

EXAMPLE

Log length: 13 m; Cylindrical butt rot length; 12 m
Diameter = 80 cm and rot 55 cm

Deduction length = $(55/80)^2$ x 12 = 5.7 metres

Net Factor = (13.0 - 5.7)/13 x 100

= **56%**

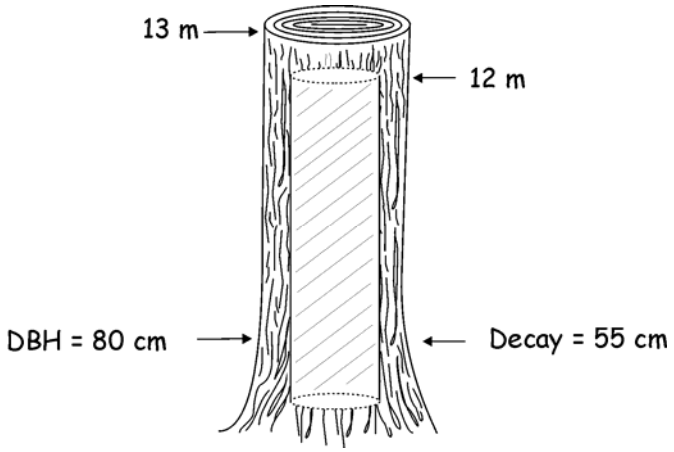

Figure 2.5 Example of Net Factor Calculation for Cylindrical Defect.

Procedure #2 - Conical Defect of Known Length

Formula

Net Factor = (Net Log Length/Log Length) x 100%

For the example below: (11.1/13) x 100% = 85%

> Note that a cone is 1/3 of the volume of a cylinder.

EXAMPLE

Log length: 13 m; conical butt rot length; 12 m
Diameter = 80 cm and rot 55 cm

Deduction length = $(55/80)^2/3 \times 12 = 1.9$ metres

Net Factor = (13.0 - 1.9)/13 x 100

= **85 %**

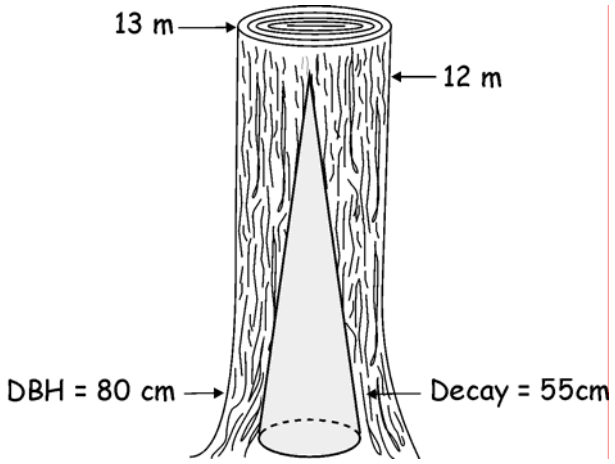

Figure 2.6 Example of Net Factor Calculation (conical).

Procedure #3 – Conical Defect of Unknown Length for Cedar Shingle Butt Logs Less Than 8m Long

EXAMPLE

Log #1 length: 4 m; cylindrical butt rot length unknown
Diameter = 80 cm and rot 55 cm

Log #2 length: 13m, use ¾ ratio on this log (55/80) = 1.2 m length deduct fromTable 10

Log #1 Deduction = $(55/80)^2$ x 4 m = 1.9 m
Net Factor = (4.0 m – 1.9 m)/4.0 m x 100% = **53%**

Log #2 Net Factor = (13.0 – 1.2)/13 x 100 % = **91 %**

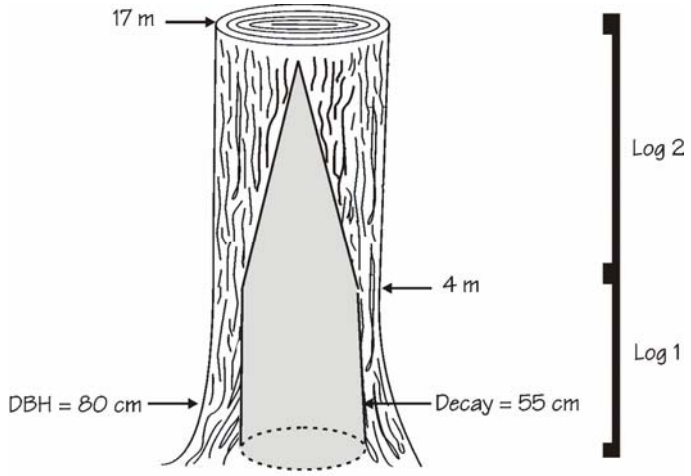

Figure 2.7 Example of Net Factor Calculation (cylindrical & conical) for Cedar Shingle.

Procedure #4 - Conical Defect of Unknown Length (See Table 10)

Formula

Net Factor = (Net Log Length/Log Length) x 100%

If the extent or length of rot is unknown then the deduction is based on the ratio of the diameter of rot at stump height to the DBH. Figure 2.5 – 55/80 = approx. ¾.

From the table (length deduction for 3/4 1.2 metres)

Net factor = (13.0 - 1.2)/13 X 100 = 91 %

1. Find the ratio (diameter of decay/DBH)
2. Use Butt Rot table for ratio of butt rot.
3. Determine the nearest ratio and apply the length deduction.
4. Net down the log length and express the net factor as a percent of the original length.

Butt rot is generally included with the log for its maximum sort length.

The Butt Rot Guide (Table 10) gives the conical butt rot ratios by log length. Note that the grade consideration in Table 10 and surface characteristics of the log will determine the sort. Deductions and grade considerations are based on diameter of rot at stump height/DBH ratio. Calculate the ratio to the nearest ¼ diameter, determine the length deduction from the table below, and calculate the net factor. The rot diameter is measured at the stump height.

Table 10 Butt Rot Guide for Length Deductions

Ratio	**Length Deduction** (volume loss)	**Grade Consideration*** (length not available for manufacture)
¼ diameter	0.2 m	0.6 m
½ diameter	0.4 m	1.8 m
¾ diameter	1.2 m	3.6 m
$^{4}/_{4}$ diameter	2.4 m	4.2 m
Sounding	0.8 m	2.4 m
P. schweinitzii	0.6 m	2.0 m
*Grade consideration denotes the loss of lumber in the log and describes the portion not available to produce 2 by 4's at least 8 feet long.		

EXAMPLE
The butt rot length is not visible, therefore we need a process to determine deduction length. Rot diameter = 55 cm; DBH = 100 cm; log length = 11 m Ratio = rot diameter/log diameter = 55/100=1/2 The deduction is 0.4 m length. Net Factor = (11-0.4)/11 = **96%**

Figure 2.8 Example of Net Factor Calculation (using butt rot table).

Sounding

Sounding will be used to assess the presence of hidden butt rot. If a hollow sound is detected then a 0.8 m deduction is removed from the butt log. Sounding cannot be applied if there is any visible rot or net factor procedure that affects the tree below 2.4 m.

Formula

EXAMPLE
Net Factor = (Net Log Length/Log Length) x 100% = (13 – 0.8)/13 x 100 = 94%

Figure 2.9 Example of Sounding Deduction.

2.3.8 Fork

In general, a fork only becomes a "pencil bucking" point if there is significant enough offset in the log that will reduce the % merch. If the crook is severe, like a school marm for example, then it may be bucked out in one-metre lengths as "Z" grade. If there is rot in the fork then it will be net factored.

Table 11 Deduction Procedure for Fork with Visible Decay

Form	Other
Method	Procedure
Deduction area	1 m below
% Sound of deduction area (net factor)	50%
Grade	Z

2.3.9 Crook

In general, a crook only becomes a "pencil bucking" point if there is a significant enough offset in the log that will reduce the % merch. If the crook is severe, like a severe pistol butt for example then it may be bucked out in one-metre lengths as "Z" grade. If there is rot in the crook then it will be net factored.

Table 12 Deduction Procedure for Crook with Visible Decay

Form	Other
Method	Procedure
Deduction area	1 m below
% Sound of deduction area (net factor)	50%
Grade	Z

2.3.10 Rotten Branch

Table 13 Deduction Procedure for Rotten Branch with Visible Decay

Form	Cylindrical
Method	Procedure
Deduction area	1 m above the rotten branch; 1 m below
% Sound of deduction area (net factor)	50%
Grade	Z or assigned

For multiple, overlapping rotten branches/knots (less than 2 m apart), deduction extends 1 m above and below the series.

2.3.11 Dead Tops

(Broken tops are handled separately.)

Rot must be visible before a net factor can be applied. Rot is treated as sap rot. If the decay is not measurable (e.g., at the top of the tree) then apply a net factor of 85% to the rotten portion. If it can be measured then use the following procedures:

Formula

Net Factor = (Net Log Length/Log Length) x 100%

For the example below: (6.9/8.0) x 100% = 86%

Table 14 Deduction Procedure for Measurable Sap Rot

Form	Other
Method	Calculate
Deduction area	From top of live crown to tree length
% Sound of deduction area (net factor)	Calculated
Grade	Assigned

Weather checked wood may affect the sort, but will not affect the sound wood content (net factor).

EXAMPLE
Midpoint diameter 20 cm, Length of rot 3 metres, Top log length 8 metres 2 cm depth of sap rot (= 16 cm of sound wood) Sound wood length $(16/20)^2$ x 3 = 1.9 metres Length Deduction = 3 – 1.9 = 1.1 metres Net Factor = (8.0 – 1.1)/8 x 100 = **86 %**

Figure 2.10 Example of Net Factor Calculation for Measurable Sap Rot.

2.3.12 Broken (Missing) Tops

The tree is graded and net factored to the broken top (pencil buck at the break). The missing portion is graded as "N" with a net factor of "00" (no sound wood).

Table 15 Deduction Procedure for Broken Tops

Form	Other
Method	Procedure
Deduction area	from break to original top
% Sound of deduction area (net factor)	00 = no sound wood (length = 99)
Grade	N (nothing)

If a top can not be assigned to a tree then it is treated as a separate piece for "in/out" procedures and is graded uniquely.

If a top is found on the ground and can be assigned to a tree, then attach it to that tree as a log and assign a grade and net factor.

Table 16 Deduction Procedure for Rot Associated with Log Below Broken Top

Form	Other
Method	Procedure
Deduction area	1 m below the break
% Sound of deduction area (net factor)	Calculated
Grade	Assigned

Visible rot is assumed to run 1 m below the break.

Formula

Net Factor = (Net Log Length/Log Length) x 100%

EXAMPLE
Last log length is 10 m up to a broken top with visible decay. Net Factor = ((10m-1.0m)/10m) * 100% = 90%, followed by a "N9900".

Figure 2.11 Example of Net Factor Calculation for Broken Tops with Decay.

2.3.13 Fallen Trees

Fallen trees with their roots attached will have a 1 metre Z-grade for the first log if they are < 100.0 cm at DBH and a 2 metre Z-grade if they are > or = to 100.0 cm. This standard is applied to account for safety and/or machine practices.

The following procedure will be used to record whether the tree is standing or fallen:

- Standing - in the down tree column (63) code blank: trees that are self supporting (that is, the tree would remain standing if all supporting materials were removed).
- Fallen - in the down tree column (63) code E or G. Refer to section A.6.3 of the *Cruising Manual*.
- If the tree has been mechanically or hand felled then the 1 m or 2 m Z grade bucking allowance does not apply.

2.3.14 Multiple Defects

In general, the assignment of net factors to trees with multiple defects is left to the professional judgement of the cruiser.

Several concepts are noted below:

Net factors less than 50% will only occur with severe:

- cylindrical butt rot,
- sap rot,
- missing wood,
- conk or blind conk segments accompanied by other indicators. (do not double call over-lapping conk and blind conk segments.), or

Sound sections 5 m or longer between defects may be treated as separate logs. If sections that are 5 m or longer are a different sort then they must be treated as separate logs. Sound segments less than 5 m are included with the adjacent log segment(s). See Figure 2.9.

EXAMPLE

Conk at 12 m and 20 m. This creates a 2 m section between the defect areas, so we can combine all three sections into one log.

Deduction length	=	$2 \times (4 + 2) = 12$ m
Log Length (from 8 m — 22 m)	=	14 m
Conk Deduction 50% (of 12 m)	=	6 m
Grade (all 3 sections)	=	Y
Net Factor	= (length of log - length of ded.)/length of log * 100%	
	= (14 m-6 m)/14 * 100%	
Net Factor	= 57%	

Note: The same procedure should be used whenever grade is assigned, particularly for butt rot and/or cat face.

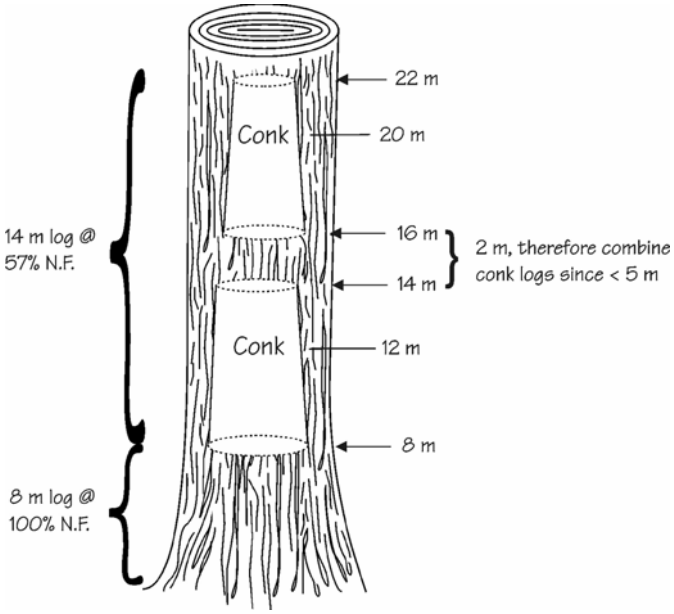

Figure 2.12 Example of Isolated Sections between Defects.

If the upper conk were at 23 m, it would create a 5 m log between the two defects. This log would be treated as a separate sound log with its own grade. This would create three separate logs, each with its own grade and net factor.

2.3.15 Dead Standing and Dead Fallen Trees

a. Dead Trees – dead trees do not have any live cambium at DBH.

b. A dead tree is tallied if it contains a butt log 8 metres or more long and has a grade of U or better. If there is at least an 8 metre U grade log then record all of the logs in the tree.

c. Dead fallen trees must have at least 8 metres of U- grade after the 1 m or 2 m Z-grade segment.

d. Dead fallen and dead standing trees that have a shattered (Z grade), broken or cut butt will commence with the 8 metre assessment after the break, shatter or cut end.

e. If down trees have been mechanically or hand felled then the 1 m or 2 m Z-grade bucking allowance does not apply.

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