

Reduction Compilations

5

5.1 Reduction Compilations - Overview

Reduction compilations use the Percent Reduction Worksheet form (FS 221 - Figure 5.1). This data is contained in a separate input file that must be submitted in ASCII format showing reductions by Treatment Unit when requested.

A version number will be placed on the top row of the ASCII file. It will start with a V followed by the year, followed by a decimal point, followed by two digits. For example, the first version in a year would be V2005.00 and the next version in the same year would be 2005.01.

Unique types should be used when a partial reduction is planned for a single block when the type being reduced extends across multiple blocks. Another use for unique types would be for Coastal mixed mature and immature block situations. The determination to use a unique type is the decision of the prescribing forest professional.

The FS 221 form allows for a reduction of the volumes and stem counts by 4 methods:

1. By species, timber type, risk group/tree class and treatment unit.
2. By species, timber type and treatment unit
3. By species, risk group/tree class and treatment unit.
4. By species and treatment unit.

When compiling a reduction, pre-reduction and post-reduction reports are required. Leave Tree summaries are also required with post-reduction reports (see Chapter 9).

The reduced volume would not be cut. The remaining reported volume is the cut volume. When coding the percentages on the FS 221 worksheet, the number coded is the net volume percent that will be left standing.

For each tree, determine whether there is an eligible reduction:

1. If a Timber Type is coded, then the reduction applies to trees in that Type.
2. If the Timber Type is blank, then the reduction applies to all types.
3. If Damage is coded B, F, I or R on the reduction card, then do not apply the reduction to trees that have been assigned a damage code of that type.
4. If Species is non-blank, then an exact species match has to apply for the tree to be eligible for reduction. Otherwise, if Species is blank, apply the reduction to all species.
5. If Risk Group/Tree Class is non-blank, then an exact Risk Group/Tree Class match has to apply for the tree to be eligible for reduction. Otherwise, if Risk Group/Tree

Class is blank, apply the reduction to all risk groups and tree classes. An "L" in the Risk Group/Tree Class column indicates all live tree classes (1, 2, 5 and 8). An "R" in the Risk Group/Tree Class column indicates all dead tree classes (3, 4, 6, 7 and 9).

When a tree is targeted for a reduction, then reduce the calculated volume by the percent value that is coded for the DBH class that the tree falls into. See Section 5.3 for example.

If the DBH class is blank, then do not apply a reduction for that tree.

Figure 5.1 Sample Percent Reduction Worksheet.

5.3 Reduction Examples

These examples use a 12.5 ha Cutting Permit with 2 types, 2 blocks and 2 harvesting methods. Cutting Permit details and pre-reduction volumes are as follows:

Type 1 has 5 ha in Silviculture Treatment Unit (STU) A

Type 2 has 5 ha in STU A & 2.5 ha in STU B

Block 1 has 2.5 ha of Type 1 (STU A) and 2.5 ha of Type 2 (STU A)

Block 2 has 2.5 ha of Type 1 (STU A) and 5 ha of Type 2 (2.5 ha of STU A & 2.5 ha of STU B)

Harvesting Method SC has 5 ha of Type 1 (STU A) and 5 ha of Type 2 (STU A)

Harvesting Method SS has 2.5 ha of Type 2 (STU B)

The Average Line Treatment Unit area factors for Block & Harvesting Method are defined as follows:

Numerator: The Treatment Unit area of the Type within Block or Harvesting Method.

Denominator: The total Treatment Unit Area for the Type.

Plots

The following plot information was used to determine the volume parameters:

Plot	Type	Block	Harvesting Method	Volume/ha estimate
1	1	1	Skid Clear	150
2	1	2	Skid Clear	230
3	1	1	Skid Clear	170
4	1	2	Skid Clear	250
5	2	1	Skid Clear	230
6	2	2	Skid Sel.	260
7	2	1	Skid Clear	210
8	2	2	Skid Sel.	260

5.3.1 Timber Type and Cutting Permit Reductions - Average Line Method

Refer to Section 3.1 for an explanation of the difference between Average Line and Block method calculations.

Average Line Method - Pre-reduction

All volume in Type 1 is in STU A because it is the only treatment unit in Type 1. Two-thirds of the volume in Type 2 is in STU A because two-thirds of the Type 2 area is in treatment unit A. One-third of the Type 2 volume in STU B because one-third of the Type 2 area is in treatment unit B.

$$\text{Type 1} = ((150+230+170+250)/4) * 5.0\text{ha} = 1000 \text{ m}^3 \text{ (1000 STU A)}$$

$$\text{Type 2} = ((230+260+210+260)/4) * 7.5\text{ha} = 1800 \text{ m}^3 \text{ (1200 STU A + 600 STU B)}$$

The Cutting Permit volume is the sum of the type volumes.

$$\text{Cutting Permit} = 1000 + 1800 = 2800 \text{ m}^3 \text{ (2200 STU A + 600 STU B)}$$

By the average line method, the Block volumes are determined based on the entire Type volumes being pro-rated based on the Type areas *within* the Block. For example, there are 5 ha of STU A in Block 1, 2.5 ha from Type 1 and 2.5 ha from Type 2. Therefore, the STU A volume for Block 1 is calculated by adding 50 percent of the Type 1 volume for STU A and 50 percent of the Type 2 volume for STU A.

The Harvesting Method volumes are calculated the same way as the Block.

The full set of calculations for the Block and Harvesting Method volumes are shown below.

	<u>Type 1</u>	<u>Type 2</u>
Block 1		
- STU A	$= (2.5/5.0 * 1000)$	$+ (2.5/5.0 * 1200) = 500 + 600 = 1100 \text{ m}^3$
Block 2		
-STU A	$= (2.5/5.0 * 1000)$	$+ (2.5/5.0 * 1200) = 500 + 600 = 1100 \text{ m}^3$
-STU B		$= (2.5/2.5 * 600) = \frac{600 \text{ m}^3}{1700 \text{ m}^3}$
Harvesting Method – SC		
-STU A	$= (5.0/5.0 * 1000) +$	$(5.0/5.0 * 1200) = 1000 + 1200 = 2200 \text{ m}^3$
Harvesting Method – SS		
-STUB	$= 0$	$+ (2.5/2.5 * 600) = 600 \text{ m}^3$

In the following examples, the reduced volumes will appear bold.

Example 5.1

Reducing the Type 2 volume by 30 percent in STU B:

Type 1 = 1000 m³ (1000 STU A)

Type 2 = **1620 m³** (1200 STU A + **420** STU B)

Type 2 has STU B, so the STU B volume was reduced by 30 percent.

Cutting Permit = 1000 + **1620** = **2620 m³** (2200 STU A + **420** STU B)

Block 1

$$\text{- STU A} = (2.5/5.0 * 1000) + (2.5/5.0 * 1200) = 500 + 600 = 1100 \text{ m}^3$$

Block 1 has no STU B, so its volume is not reduced.

Block 2

$$\begin{aligned} \text{-STU A} &= (2.5/5.0 * 1000) + (2.5/5.0 * 1200) = 500 + 600 = 1100 \text{ m}^3 \\ \text{-STU B} &= (2.5/2.5 * \mathbf{420}) = \mathbf{420 \text{ m}^3} \\ &\quad \mathbf{1520 \text{ m}^3} \end{aligned}$$

Block 2 has STU B from Type 2, so its volume was reduced.

Harvesting Method – SC

$$\text{-STU A} = (5.0/5.0 * 1000) + (5.0/5.0 * 1200) = 1000 + 1200 = 2200 \text{ m}^3$$

Harvesting Method - SC has no STU B, so its volume was not reduced.

Harvesting Method – SS

$$\text{-STUB} = 0 + (2.5/2.5 * \mathbf{420}) = \mathbf{420 \text{ m}^3}$$

Harvesting Method - SS only has STU B, so its volume was reduced by 30 percent.

Example 5.2

Reducing the Cutting Permit volume by 10 percent in STU A:

$$\text{Type 1} = 900 \text{ m}^3 \quad (900 \text{ STU A: } 1000 * 0.9)$$

$$\text{Type 2} = 1680 \text{ m}^3 \quad (1080 \text{ STU A: } 1200 * 0.9 + 600 \text{ STU B})$$

STU A was reduced by 10 percent for each Timber Type.

$$\text{Cutting Permit} = 900 + 1680 = 2580 \text{ m}^3 \quad (1980 \text{ STU A} + 600 \text{ STU B})$$

	<u>Type 1</u>	<u>Type 2</u>
Block 1	- STU A = $(2.5/5.0 * 900)$	+ $(2.5/5.0 * 1080) = 450 + 540 = 990 \text{ m}^3$

Block 1 only has STU A, so its volume was reduced by 10 percent.

Block 2	-STU A = $(2.5/5.0 * 900)$	+ $(2.5/5.0 * 1080) = 450 + 540 = 990 \text{ m}^3$
	-STU B = 0	= $(2.5/2.5 * 600) = 0 + 600 = \underline{600 \text{ m}^3}$
		1590 m³

Harvesting Method – SC

$$\text{-STU A} = (5.0/5.0 * 900) + (5.0/5.0 * 1080) = 900 + 1080 = 1980 \text{ m}^3$$

Harvesting Method - SC only has STU A, so its volume was reduced by 10 percent.

Harvesting Method – SS

$$\text{-STUB} = 0 + (2.5/2.5 * 600) = 0 + 600 = 600 \text{ m}^3$$

5.3.2 Block and Timber Type Reductions - Block Method

Refer to Section 3.1 for an explanation of the difference between Average Line and Block method calculations.

Block Method - Pre-reduction

$$\text{Type 1} = 1000 \text{ m}^3 \quad (1000 \text{ STU A})$$

$$\text{Type 2} = 1800 \text{ m}^3 \quad (1200 \text{ STU A} + 600 \text{ STU B})$$

$$\text{Cutting Permit} = 1000 + 1800 = 2800 \text{ m}^3 \text{ (2200 STU A + 600 STU B)}$$

The Type and Cutting Permit volumes do not change for the Block method.

$$\begin{aligned} \text{Type 1/Blk 1} &= ((150+170)/2) * 2.5\text{ha} = 400 \text{ m}^3 \quad (400 \text{ STU A}) \\ \text{Type 1/Blk 2} &= ((230+250)/2) * 2.5\text{ha} = 600 \text{ m}^3 \quad (600 \text{ STU A}) \\ \text{Type 2/Blk 1} &= ((230+210)/2) * 2.5\text{ha} = 550 \text{ m}^3 \quad (550 \text{ STU A}) \\ \text{Type 2/Blk 2} &= ((260+260)/2) * 5.0\text{ha} = 1300 \text{ m}^3 \quad (650 \text{ STU A} + 650 \text{ STU B}) \\ \\ \text{Type 1/SC} &= ((150+230+170+250)/4) * 5.0 \text{ ha} = 1000 \text{ m}^3 \quad (1000 \text{ STU A}) \\ \text{Type 2/SC} &= ((230+210)/2) * 5.0 \text{ ha} = 1100 \text{ m}^3 \quad (1100 \text{ STU A}) \\ \text{Type 2/SS} &= ((260+260)/2) * 2.5 \text{ ha} = 650 \text{ m}^3 \quad (650 \text{ STU B}) \end{aligned}$$

	<u>Type 1</u>	<u>Type 2</u>
Block 1		
	- STU A = 400	+ 550 = 950 m ³
Block 2		
	-STU A = 600	+ 650 = 1250 m ³
	-STU B = 0	+ 650 = $\frac{650 \text{ m}^3}{1900 \text{ m}^3}$
Harvesting Method - SC		
	-STU A = 1000	+ 1100 = 2100 m ³
Harvesting Method - SS		
	-STUB = 0	+ 650 = 650 m ³

In the following examples, the reduced volumes will appear bold.

Example 5.3

Reducing the volume by 20 percent of STU B in Block 2:

$$\begin{aligned} \text{Type 1} &= 1000 \text{ m}^3 \quad (1000 \text{ STU A}) \\ \text{Type 2} &= \mathbf{1680 \text{ m}^3} \quad (1200 \text{ STU A} + \mathbf{480 \text{ STU B}}) \end{aligned}$$

Block 2 has STU B in Type 2, so Type 2 was reduced.

$$\text{Cutting Permit} = 1000 + 1680 = \mathbf{2680 \text{ m}^3}$$

$$\text{Type 1/Blk 1} = 400 \text{ m}^3 \text{ (400 STU A)}$$

$$\text{Type 1/Blk 2} = 600 \text{ m}^3 \text{ (600 STU A)}$$

$$\text{Type 2/Blk 1} = 550 \text{ m}^3 \text{ (500 STU A)}$$

$$\text{Type 2/Blk 2} = \mathbf{1170 \text{ m}^3} \text{ (650 STU A + 520 STU B)}$$

$$\text{Type 1/SC} = 1000 \text{ m}^3 \text{ (1000 STU A)}$$

$$\text{Type 2/SC} = 1100 \text{ m}^3 \text{ (1100 STU A)}$$

$$\text{Type 2/SS} = \mathbf{520 \text{ m}^3} \text{ (520 STU B)}$$

	<u>Type 1</u>	<u>Type 2</u>
Block 1		
	- STU A = 400	+ 550 = 950 m ³
Block 2		
	-STU A = 600	+ 650 = 1250 m ³
	-STU B = 0	+ 520 = <u>520 m³</u>
		1770 m³

Block 2 has STU B, so its volume was reduced.

Harvesting Method - SC

$$\text{-STU A} = 1000 \quad + 1100 = 2100 \text{ m}^3$$

Harvesting Method - SS

$$\text{-STUB} = 0 \quad + \mathbf{520} = \mathbf{520 \text{ m}^3}$$

Block 2 has STU B in Harvesting Method - SS, so its volume was reduced.

Example 5.4

Reducing Type 2 volume by 50 percent in STU A results in:

$$\text{Type 1} = 1000 \text{ m}^3 \text{ (1000 STU A)}$$

$$\text{Type 2} = \mathbf{1200 \text{ m}^3} \text{ (600 STU A + 600 STU B)}$$

Type 2 has STU A, so its volume was reduced.

$$\text{Cutting Permit} = 1000 + 1200 = 2200 \text{ m}^3$$

Type 1/Blk 1	= 400 m ³	(400 STU A)
Type 1/Blk 2	= 600 m ³	(600 STU A)
Type 2/Blk 1	= 275 m³	(275 STU A)
Type 2/Blk 2	= 975 m³	(325 STU A + 650 STU B)

Type 1/SC	= 1000 m ³	(1000 STU A)
Type 2/SC	= 550 m³	(550 STU A)
Type 2/SS	= 650 m ³	(650 STU B)

	<u>Type 1</u>	<u>Type 2</u>
Block 1		
- STU A	= 400	+ 275 = 675 m³

Block 1 has STU A in Type 2, so its volume was reduced.

Block 2		
-STU A	= 600	+ 325 = 925 m³
-STU B	= 0	+ 650 = <u>650 m³</u>
		= 1575 m ³

Block 2 has STU A in Type 2, so its volume was reduced.

Harvesting Method - SC		
-STU A	= 1000	+ 550 = 1550 m³

Harvesting Method – SS		
-STUB	= 0	+ 650 = 650 m ³

Harvesting Method - SS doesn't have STU A, so its volume was not reduced.

5.3.3 Single Tree Reduction

The previous 4 examples in this chapter demonstrated how the total volume for a Treatment Unit would be reduced if all the trees from a particular cross-section were reduced. However, reductions can be dependent on individual tree parameters such as DBH, Tree Class/Risk Group and Damage Type. The reductions are performed on a tree-by-tree basis as follows.

Example 5.5

The sample reduction input in Section 5.5 indicates a 20 percent reduction in Type 2 - Treatment Unit B for Yellow Cedar with a DBH up to 150 cm. All Risk Groups and Tree Classes are included, and no Damage Types are excluded from the reduction.

A Yellow Cedar was tallied in a plot from Type 2 within Block 2. Recall that Type 2/Block 2 has 2 Treatment Units, each having an area of 2.5 ha. Because the Treatment Unit cannot be coded on the Cruise Tally Sheet, the plot determines volume per hectare for both Treatment Units in Type 2 within Block 2.

The Yellow Cedar was tallied using a BAF of 12 in a full plot and the measured DBH was 55.6 cm. The calculated gross merchantable volume was 3.583566 m³. Hence, the pre-reduction estimate for gross volume per hectare for both Treatment Units is:

$$\begin{aligned}(1) \quad V &= \frac{(12 \ 12732.39545) * (3.583566)}{55.6^2} \\ &= \mathbf{177.12 \ m^3 \text{ per hectare}}\end{aligned}$$

The post-reduction estimate for Treatment Unit B is:

$$\begin{aligned}(2) \quad V &= 177.12 (1 - 0.2) \\ &= \mathbf{141.69 \ m^3 \text{ per hectare}}\end{aligned}$$

The post-reduction estimate for the two combined Treatment Units is:

$$\begin{aligned}(3) \quad V &= (2.5/5.0) * 177.12 + (2.5/5.0) * 141.69 \\ &= \mathbf{159.40 \ m^3 \text{ per hectare}}\end{aligned}$$

5.4 Percent Reduction Card Edits

5.4.1 Table of Data Types

Column Position	Column Name	Accepted Values	Error Type
1-2	Species	Blank or valid species code (Refer to Appendix 3 for valid species codes)	F
3-4	Timber Type	Blank, 99	F
5	Risk Group/Tree Class	Blank, A, B, C, D, 1 - 9, L and R	F
6-7	Treatment Unit	A - CU, 1-99	F
8-10	Block	Blank	F
11	Damage type	Blank, B, F, I, R	F
12-13	N/A		
14-15, 16-17, ..., 80-81	Reduction percent for DBH class	Blank, 001 – 100	F

5.4.2 Fatal Errors

1. A tree can only qualify for one reduction.
2. Timber Type must be a valid Type from a card type C.
3. Block must be a valid Block from a card type D.

5.5 Percent Reduction Input Values - Sample Listing

Report 005a. This report is required for reduction compilations.

[illegible]

Figure 5.2 Percent Reduction Input Values.