

STANDARD OPERATING PROCEDURE 4 (SOP4): DATA ANALYSIS

Version	1.1	Date of Issue	14/06/2021
Purpose	This SOP provides for area estimates and their uncertainties through the combined use of reference data and maps (i.e., sample-based area estimation)		

Procedure

Step 1: Establishing the proportion matrix

Sub-step 1a. The excel form for calculations is used to calculate the required outputs. The Statistician builds a matrix that shows the strata (map classes) and the reference classes. The matrix lists counts of sampling units and areas of the stratification map in accordance with the table below

	<i>Reference data (j)</i>			
<i>Strata (h)</i>	<i>Class j1</i>	<i>Class j2</i>	<i>Class j3</i>	<i>Total</i>
<i>Stratum h1</i>	<i>n11</i>	<i>n12</i>	<i>n13</i>	<i>n1.</i>
<i>Stratum h2</i>	<i>n21</i>	<i>n22</i>	<i>n23</i>	<i>n2.</i>
<i>Stratum h3</i>	<i>n31</i>	<i>n32</i>	<i>n33</i>	<i>n3.</i>
<i>Total</i>	<i>n.1</i>	<i>n.2</i>	<i>n.3</i>	<i>n</i>

The error matrix is recorded using Form 5.

In building the error matrix, no-response observations, e.g., no data available such as persistent clouds throughout the period, shall be excluded. That means that for no-response observation, the total count in the relevant stratum (map class) is reduced. The coordinator records the number of non-response samples and the reasons they were excluded using Form 5.

Sub-step 1b. The Statistician calculates strata weights dividing the area of each class or stratum by the total reporting area in accordance with the table below.

Stratum	Map area in hectares	Strata weight (wh)
<i>Stratum h1</i>	<i>a_{1.}</i>	<i>a_{1.}/a</i>
<i>Stratum h2</i>	<i>a_{2.}</i>	<i>a_{2.}/a</i>
<i>Stratum h3</i>	<i>a_{3.}</i>	<i>a_{3.}/a</i>
Total	<i>a</i>	<i>1</i>

The table with the strata weights is recorded using Form 5.

Sub-step 1c. The Statistician calculates area proportions per class in accordance with the table below. For each cell, the area proportion is defined as:

$$\hat{p}_{hj} = w_h \cdot \frac{n_{hj}}{n_{h.}}$$

where *h* and *j* stand for row and column, respectively.

	Reference data (j)				
	Stratum (h)	Class j1	Class j2	Class j3	Total
	Stratum h1	\hat{p}_{11}	\hat{p}_{12}	\hat{p}_{13}	$\hat{p}_{1\bullet}$
	Stratum h2	\hat{p}_{21}	\hat{p}_{22}	\hat{p}_{23}	$\hat{p}_{2\bullet}$
	Stratum h3	\hat{p}_{31}	\hat{p}_{32}	\hat{p}_{33}	$\hat{p}_{3\bullet}$
Total	$\hat{p}_{\bullet 1}$	$\hat{p}_{\bullet 2}$	$\hat{p}_{\bullet 3}$	1	

The table with the area proportion per reference class is recorded using Form 5.

Sub-step 1d.

The coordinator shall store standards form 1-5 with the climate change unit of the forestry commission, the resources management support Centre and the, national forest monitoring system

Step 2: Estimating areas and their uncertainty

Sub-step 2a. The Statistician estimates the area per class:

$$A_j = p_{.j} * a$$

Sub-step 2b. The Statistician estimates the standard error for the reference class area proportions:

$$S(p_{.j}) = \sqrt{\sum_h w_h^2 \frac{p_{hj}(1-p_{hj})}{n_h - 1}}$$

Sub-step 2c. The Statistician estimates the standard error for the reference class areas:

$$S(A_j) = S(p_{.j}) * a$$

Sub-step 2d. The Statistician estimates the percentage uncertainty of the estimated area per class. The value for Student's *t* must be chosen for the appropriate confidence level α and the degrees of freedom, $df = n_h - H - 1$.

$$U\%(A_j) = t_{\alpha, df} * S(A_j) / A_j$$

Sub-step 2e. The Statistician builds a summary table and reports it in Form 5. The form shall be stored data hub hosted by the Climate Change Directorate.

Quality management	
QA / QC procedures	<p>Sub-step Q1. The Coordinator checks that the calculations comply with this SOP, including the script used for calculations.</p> <p>Sub-step Q2. The Coordinator cross-checks the estimates against previously reported estimates for the same classes. Estimates are additionally cross-checked and compared with globally reported estimates.</p>

Version Log

Version	Author/s	Material changes from previous version	Release Date
1.1	1. Mr.Yakubu Mohammed(Coordinator) 2. Mr.Thomas Gyambrah 3. Mr.Jacob Amoako 4. Ms.Tessia Boateng 5. Dr.Marieke Sandker 6. Ms.Yelena Finegold		14/06/2021