

STANDARD OPERATING PROCEDURE 4 (SOP4): DATA ANALYSIS

Version	1.1	Date of Issue	14/06/2021
Purpose	<p>This SOP provides for area estimates and their uncertainties through the combined use of reference data and maps (i.e., sample-based area estimation)</p> <p><i>Note: These SOP can also be applied where no stratification is used. In this case, step 1 can be omitted. In step 2, the number of strata is one. The area proportion are then used as proportion of observations without the need to adjust for a strata weight.</i></p>		
Responsibilities	<p><i>“Coordinator”: the coordinator will be responsible for discussing with the Statistician the right sampling design. The coordinator shall be nominated from within or outside the forestry commission. The coordinator shall have understanding of remote sensing, forest inventory and basic statistics. He will coordinate all data analysis and report appropriately to the director of climate change or his rep</i></p>		
Prerequisites	Data collection completed (SOP 3)		
Related documents	<p><i>This SOP shall make reference to SOP 1.2 and 3. It shall also refer to SOP 003.004, 003.1.2.1 and 1.2.2 developed by Indutor / Forest Consult / BIRD SOP 1 Sample design, SOP 2 Response design, SOP 3 Data collection as well as standard forms 1 - 5, National forest monitoring system and the national definition of forest. The GHG INVENTORY REPORTS AND THE NATIONAL COMMUNICATION TO THE UNFCCC BY THE BIA</i></p>		

Procedure																															
Step 1: Establishing the proportion matrix	<p>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</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th colspan="4">Reference data (j)</th> </tr> <tr> <th>Strata (h)</th> <th>Class j1</th> <th>Class j2</th> <th>Class j3</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>Stratum h1</td> <td>n11</td> <td>n12</td> <td>n13</td> <td>n1.</td> </tr> <tr> <td>Stratum h2</td> <td>n21</td> <td>n22</td> <td>n23</td> <td>n2.</td> </tr> <tr> <td>Stratum h3</td> <td>n31</td> <td>n32</td> <td>n33</td> <td>n3.</td> </tr> <tr> <td>Total</td> <td>n.1</td> <td>n.2</td> <td>n.3</td> <td>n</td> </tr> </tbody> </table> <p>The error matrix is recorded using Form 5.</p> <p>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.</p>		Reference data (j)				Strata (h)	Class j1	Class j2	Class j3	Total	Stratum h1	n11	n12	n13	n1.	Stratum h2	n21	n22	n23	n2.	Stratum h3	n31	n32	n33	n3.	Total	n.1	n.2	n.3	n
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Stratum h3	n31	n32	n33	n3.																											
Total	n.1	n.2	n.3	n																											

Commented [1]: @Yelena.Finegold@fao.org Where can we fit the MC analysis in as part of the uncertainties ?
Assigned to yelena.finegold

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)
Stratum h1	a_1	a_1/a
Stratum h2	a_2	a_2/a
Stratum h3	a_3	a_3/a
Total	a	1

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.

Stratum (h)	Reference data (j)			Total
	Class j1	Class j2	Class j3	
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

Note: in case a stratification was not applied but where a simple random sampling or a systematic sampling was used, the below equations are still applicable. In this case, the area proportion p.j is simply calculated as a proportion of observations without the need to adjust for a strata weight.

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:

	$S(A_j) = S(p.j) * a$ <p>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, $df = n_h - H - 1$.</p> $U\%(A_j) = t_{\alpha, df} * S(A_j) / A_j$ <p>Sub-step 2e. The Statistician builds a summary table and reports it in Form 5. The form shall be stored <i>indicate the appropriate place for storing the form in accordance with your requirements</i></p> <p><i>The coordinator shall store standards form 5 with the climate change unit of the forestry commissioner, the province management support Centre and the national forest monitoring system and the ICT unit. A data management and storage platform yet to be develop under the national forest monitoring system</i></p> <p><i>If a software is used to compute this, these steps may be replaced or completed with the steps needed to operate the applicable software or tool.</i></p>
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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