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| Standard Operating Procedure 4 (Sop4): Data Analysis |
| Version | *Insert version number of the SOP. Use version log at the end of the SOP for version control* | **Date of Issue** | *Insert date on which this version of the SOP was issued* |
| 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*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.* |
| Responsibilities | *Clarify the roles and responsibilities as the instruction will refer to these. For example* *‘Coordinator”: the coordinator will be responsible for discussing with the Statistician the right sampling design,….”* |
| Prerequisites | Data collection completed (SOP 3) |
| Related documents | *Insert references to related documents, including other SOPs, standard forms and other materials that are part of your monitoring system* |

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| Procedure |
| Step 1: Establishing the proportion matrix | **Sub-step 1a.** 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

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|  | *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* |

The error matrix is recorded using form *indicate the possible standard form(s) to be used. Template 5 can be used as a basis to create a standard form.* 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 *indicate the possible standard form(s) to be used. Template 5 can be used as a basis to create a standard form* **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.

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| Stratum | Map area in hectares | Strata weight (wh) |
| *Stratum h1* | *a1.* | *a1./a* |
| *Stratum h2* | *a2.* | *a2./a* |
| *Stratum h3* | *a3.* | *a3./a* |
| Total | *a* | *1* |

The table with the strata weights is recorded using form *indicate the possible standard form(s) to be used. Template 5 can be used as a basis to create a standard form.* **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:where *h* and *j* stand for row and column, respectively.

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|  | Reference data (j) |
| *Stratum (h)* | *Class j1* | *Class j2* | *Class j3* | Total |
| *Stratum h1* |  |  |  |  |
| *Stratum h2* |  |  |  |  |
| *Stratum h3* |  |  |  |  |
| Total |  |  |  | *1* |

The table with the area proportion per reference class is recorded using form *indicate the possible standard form(s) to be used. Template 5 can be used as a basis to create a standard form.* **Sub-step 1d.** The Coordinator stores the form with the outcomes of the previous sub-steps in *indicate the appropriate place for storing the form in accordance with your requirements*.*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.  |
| 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:Aj = p.j \* a**Sub-step 2b.** The Statistician estimates the standard error for the reference class area proportions:S(p.j) = $\sqrt{\sum\_{h}^{}w\_{h}^{2}\frac{p\_{hj}\left(1-p\_{hj}\right)}{n\_{h}-1}}$**Sub-step 2c.** The Statistician estimates the standard error for the reference class areas:S(Aj) = 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%(Aj) = t *α*, df \* S(Aj) / Aj**Sub-step 2e.** The Statistician builds a summary table and reports it in form …. *indicate the possible standard form(s) to be used. Template 5 can be used as a basis to create a standard form*. The form shall be stored *indicate the appropriate place for storing the form in accordance with your requirements**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.* |

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| Quality management  |
| QA / QC procedures | **Sub-step Q1.** The Coordinator checks that the calculations comply with this SOP, including the script used for calculations. **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 reported estimates from other sources (e.g. Global Forest Resource Assessment, national greenhouse gas inventory, UNFCCC reporting, Global Forest Watch).  |

**Version Log**

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| Version | Author/s | Material changes from previous version | Release Date |
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