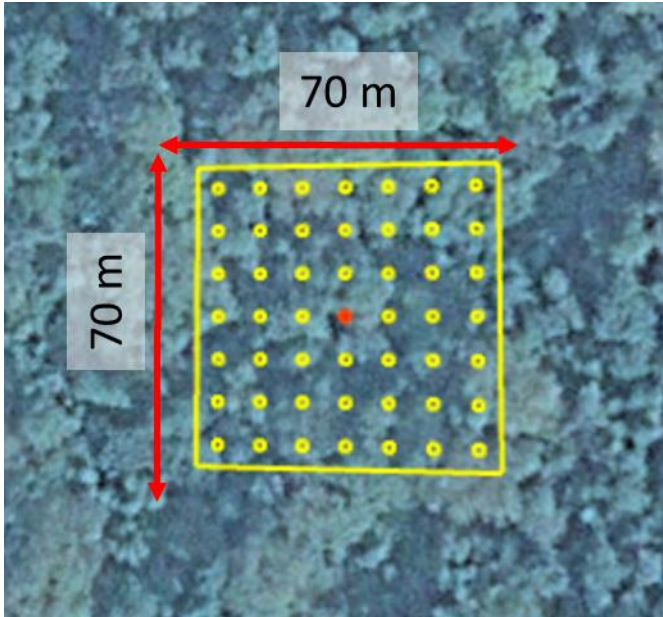


FORM 1: SAMPLING DESIGN

Purpose and scope	The sample design purpose and scope covers the Ghana Cocoa Forest REDD+ Programme (GCFRP) area and is used for reference level estimates reported in the Emissions Reductions Program Document (ERPD) to the Forest Carbon Partnership Facility (FCPF). The sampling design is also used for the monitoring period report.
Version	Version 1
Date	September 2020

Basic characteristics of the sampling design

Type of sampling and sample units	Stratified systematic Points
Shape and size of the spatial support	<p>The shape of the spatial support area is a square with the size of 0.5 hectare with an internal 7 x 7 grid of control points. The size of the control points are 2 meters, the distance between the control points is 10 meters and the distance between the control points and perimeter of the spatial support square is 5-meters.</p>  <p>Figure 1: Spatial support unit</p>
Explanation	The size and shape of the spatial support frame was chosen to be consistent with previous national scale sample based area estimation exercises.

The national scale sample based area estimation showed robust results and the same parameters were used to intensify for the GCFRP area.

During the data collection with the Planet data, which has an online viewing resolution of about 5 meters, the size of the spatial support made it difficult to assess the land cover class and change. In order to effectively incorporate images with a resolution 5 meters or greater, a larger spatial support unit can be considered in future pilot surveys. The pilot survey data for this assessment was assessed before there was access to Planet Labs, therefore it is not a suggestion from the pilot phase but from the operational phase.

Definitions of strata (for cases where stratified [random/ systematic] sampling has been selected)

Stratum number	Stratum name	Description of the stratum	Area in stratification map ah
1	Forest mask	Areas mapped as forest in the available land cover maps between 2000-2015	3,295,919
2	Outside forest mask	Areas mapped as non-forest in the available land cover maps between 2000-2015	2,555,905
3	Upland evergreen	Upland evergreen vegetation zone	62,601

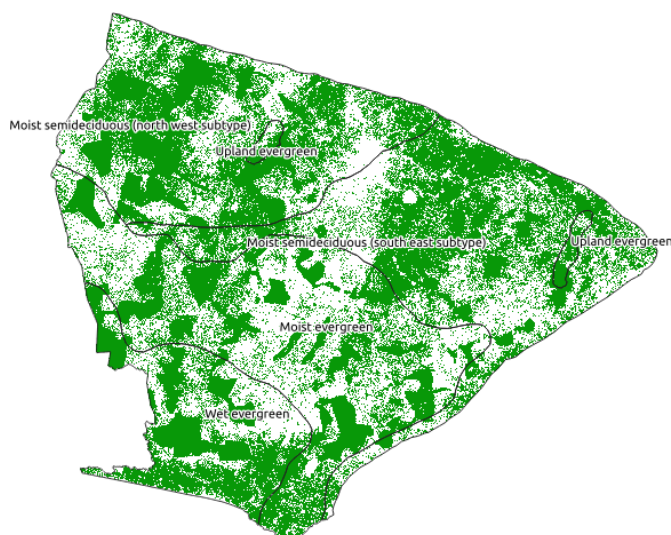


Figure 2 Forest mask used for stratification of intensified sampling and vegetation zones used as stratification and post-stratification

Explanation:

Initially a systematic sample without stratification was used as a pilot study then the systematic sample was consistently intensified using stratification. First 8 x 8 meter grid of samples was assessed at the national scale as a successful pilot study and was then intensified to a 4 x 4 meter grid in the GCFRP area. It was decided to use a stratification to further intensify the sample in forested areas in order to target areas that could potentially be deforested or degraded. The areas inside the forest mask were intensified with a 2 x 2 meter systematic grid, except in the upland evergreen vegetation zone. The forest mask was the choice stratification because a map of deforestation and forest degradation had yet to be finalized for the GCFRP area. Intensification in forested areas was considered a conservative approach for delineating areas of increased potential for forest change. In the

upland evergreen vegetation zone, the sampling was intensified to a 1 x 1 meter grid. Upland evergreen was chosen as an additional stratification because estimates are reported by vegetation zone and as this is the smallest vegetation zone it required additional samples to sufficiently quantify change in this area.

Vegetation zones are used as a post-stratification to estimate areas within each vegetation zone with the exception of upland evergreen which is considered a stratum. Vegetation zones are chosen as a stratum (upland evergreen) and post-stratification because emission factors are reported by these areas and corresponding activity data for these data should be reported.

Post-stratum name	Area in post-stratification map ah
Moist evergreen	1,832,389
Moist semideciduous (north west subtype)	1,557,590
Moist semideciduous (south east subtype)	1,727,082
Wet evergreen	734,763

The stratification is not sufficient for reducing the variance in activity data estimates and in future assessments a pure systematic sample approach can be considered or other stratification that effectively reduces the sampling error. New stratification should first be piloted to understand whether the stratification reduces the sampling error as explained in the instructions.

Number of sample units allocated

	Number of sample units per vegetation zone	Grid spacing (km)	Area per stratum (ha), $A_{e,i}$	Number of sample units per stratum, $n_{e,i}$	Weight per sample unit (ha/unit)	Number of deforestation plots (2005-2014)	Number of degradation plots (2005-2014)
Moist evergreen	2,123	2x2	886,983	1,384	641	7	12
		4x4	945,406	739	1,279	16	4
Moist SemiD NW	2,045	2x2	962,079	1,554	619	31	17
		4x4	595,511	491	1,213	9	4
Moist SemiD SE	2,148	2x2	989,659	1,543	641	32	17
		4x4	737,423	605	1,219	8	2
Wet evergreen	981	2x2	457,198	753	607	4	3
		4x4	277,565	228	1,217	2	1
Upland evergreen	392	1x1	62,601	392	160	11	5

Data collection phase	Sampling intensity	Number of points	Sample distribution	scale	Assessment period	Date of data collection
1	8 x 8	Nationally: 2,936 Cocoa area: 737	systematic	national	2000-2019	5-14 June 2019
2	4 x 4	3,601	systematic	sub-national scale, cocoa forest programme area	2000-2019	16-20 December 2019
3	2 x 2 & 1 x 1	2x2 grid: 6,328 1x1 grid: 588	stratified systematic	sub-national scale, cocoa forest programme area, 2 x 2 systematic grid in forested areas within 4 vegetation zones and 1 x 1 systematic grid in, upland evergreen vegetation zone.	2000-2019	3-11 February 2020

Explanation:

A pilot survey was conducted using the first 8 x 8 meter spacing grid of sample plots. The samples were further intensified using a 4 x 4 meter grid in the GCFRP and a second round of intensification in areas identified using a 2 x 2 meter grid forest in the forest mask (excluding the Upland Evergreen vegetation zone) and a 1 x 1 meter grid in the Upland Evergreen vegetation zone.

Sample unit allocation

The systematic grid is extracted for the spatial extent of Ghana from a globally generated systematic grid. A database of additional samples is archived in order to ensure the consistency with the original grid. The starting point of the global grid is random and includes sampling intensities at 1, 2, 3, 4, 5, 6, 8, 9, 10, 12, 15, 16, 20, 25, 30, 50, and 100 meters. The systematic grid is stored in [the Climate Change Department of Forestry Commission, Google Drive.](#) ~~location where the systematic grid for intensification is stored.~~