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KLIMAVERIFIKASJON

# Verification of Interim REDD+ Performance indicators under the Guyana-Norway REDD+ partnership (Year 6)

Ministry of Environment– Government of Norway

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## Task and objective:

DNV GL AS (DNV GL) has been commissioned by the Ministry of Environment- Government of Norway to perform a verification of the Interim Performance Indicators reported for the period 1 January 2015 to 31 December 2016 - Year 6 as described in the Guyana REDD+ Monitoring Reporting and Verification System (MRVS) - Interim Measures Report, Version 3 produced by the Guyana Forestry Commission - Government of Guyana.

This report provides the verification methodology, results and statement.

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### Keywords:

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Reference to part of this report which may lead to misinterpretation is not permissible.

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# 1 DNV GL VERIFICATION STATEMENT

## Verification Objective

DNV GL AS (DNV GL) has been commissioned by the Norwegian Ministry of Environment\* to perform a verification of the Interim Performance Indicators under the Guyana-Norway partnership on REDD+ as reported in the Interim Measures Report†

## Verification Scope

The relevant list of indicators for this verification is found in the most recent version of the Joint Concept Note (JCN) (third revision). The scope of this verification covers the following deforestation and degradation indicators:

Report Measure	Measure Ref	Indicator
Deforestation Indicators	1	Indicator 1: Gross Deforestation rate
Degradation Indicators	2	Indicator 2.1: Loss of intact forest landscapes
	3	Indicator 2.2: Forest Management (i.e. selective logging activities in natural or semi natural forests)
	2b	Indicator 2.3: Carbon loss as indirect effect of new infrastructure.
	6	Indicator 2.4: Emissions resulting from subsistence forestry, land use and shifting cultivation lands (i.e. slash and burn agriculture)
	4	Indicator 2.5: Emissions resulting from illegal logging activities.
	5	Indicator 2.6: Emissions resulting from anthropogenic forest fires.

For this monitoring period, there are a few indicators that are not required to be reported by the JCN in the current monitoring period and therefore have not been considered within the scope of this statement. These are:

Indicator on increased carbon removals	7	Indicator 3.1: Encouragement of increasing carbon sink capacity of non-forest and forest land
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In addition, DNV GL has assessed if the changes in the methodology applied for the determination of each Interim Performance Indicator in the previous verification period, particularly those obtained via geographical analysis, follows good practices as defined by a number reference documents (see below).

The geographical boundary of the verification is Guyana and the period covered is 1 January 2015 to 31 December 2016.

\* Contract and scope signed between The Norwegian Ministry of Environment and DNV GL on 8 October 2014

† Guyana REDD+ Monitoring Reporting and Verification System (MRVS) - Interim Measures Report, Guyana Forestry Commission, 07 February 2018



## Materiality

No level of materiality has been fixed by the Norwegian Ministry of Environment for this verification so any individual or aggregate errors, omissions and misrepresentations which result in discrepancies have been considered as material and requested to be corrected if feasible. This does not include individual or aggregate level of errors associated with technical equipment (e.g. sensors) or remote sensing methods (e.g. visual interpretation). However, for Indicator 1 - Gross deforestation rate and Indicator 2.1 - Loss of intact forest landscapes, have been addressed by an independent accuracy assessment performed by the Durham University.

## Verification criteria

The following reference requirements have been considered during the verification by DNV GL:

- Join Concept Note on REDD+ cooperation between Guyana and Norway, Section 3: REDD-plus performance Indicators (dated 9 November 2009 and its amendment of March 2010 and March 2011).
- GOFC-GOLD REDD Source Book (2014).
- IPCC Guidelines for National Greenhouse Gas Inventories (2006) – Volume 4 Agriculture, Forestry and Other Land Use.
- Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (2000) – Chapter 4: Agriculture; Chapter 6: Quantifying; Chapter 8: Quality Assurance and Quality Control.

## Verification activities

The verification has been guided by the provisions of ISO 14064-3 (1 ed., 2006) that cover the validation and verification of greenhouse gas assertions.

The verification took place from 02 February 2018 until 22 February 2018 and included desk reviews of relevant documentation and datasets as listed in the verification report and an on-site assessment in Guyana from 15 February 2018 to 22 February 2018.

As part of the verification, the results of the independent accuracy assessment included in the Interim Measures Report were verified.

## Conclusions

It is DNV GL's opinion that the results provided in the Interim Measures Report by Guyana Forestry Commission:

- have been obtained applying methodologies in accordance with internationally accepted good practices as defined by the verification criteria;
- are free from omissions and misrepresentations that could lead to material misstatements.

Furthermore, recommendations for improvements in future monitoring periods are summarised as Minor Corrective Action Requests (MINORs) or Observations. These MINORs and Observations are listed in Appendix A of the Verification Report.

DNV GL has verified that the values for the interim indicators in this monitoring period (1 January 2015 to 31 December 2016) are:

<b>Measure Ref</b>	<b>Indicator</b>	<b>Year 6 results</b>
1	Indicator 1: Gross Deforestation rate in Year 6	0.05%
2	Indicator 2.1: Loss of intact forest landscapes	7 604 024 ha (290 ha loss)
2b	Indicator 2.3: Carbon loss as indirect effect of new infrastructure.	5 679 ha
3	Indicator 2.2: Forest Management	1 892 371 tCO <sub>2</sub>
4	Indicator 2.5: Emissions resulting from illegal logging activities.	9 140 tCO <sub>2</sub>
5	Indicator 2.6: Emissions resulting from anthropogenic forest fires.	762 ha/year
6	Indicator 2.4: Emissions resulting from subsistence forestry, land use and shifting cultivation lands (i.e. slash and burn agriculture)	93 ha/yr
7	Indicator 2.7: Encouragement of increasing carbon sink capacity of non-forest and forest land	Not part of the reporting obligations of this year

Statement Issuing date

20 April 2018



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*Team Leader*



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*Head of Section*

-----END OF STATEMENT-----

## 2 INTRODUCTION

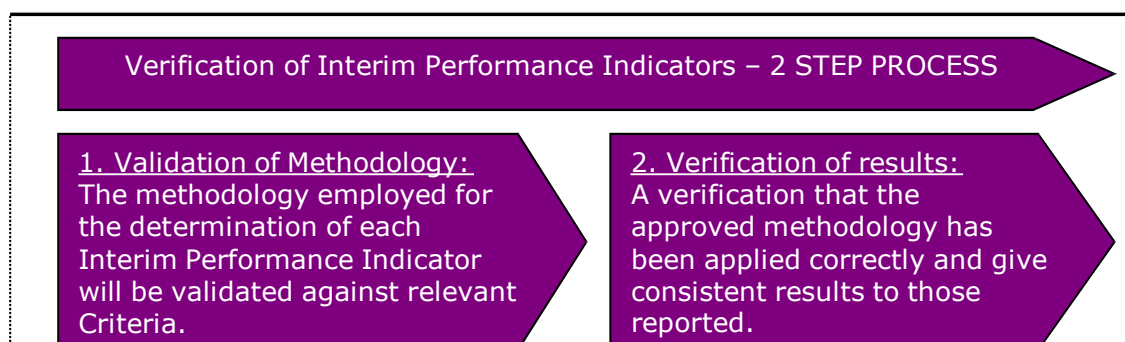
DNV GL AS (DNV GL) has been contracted by the Ministry of Environment– Government of Norway to perform a non-accredited verification of Interim REDD+ Performance indicators under the Guyana-Norway REDD+ partnership. According to the Joint Concept Note (JCN) signed between both parties, these indicators will serve to evaluate Guyana’s performance regarding REDD+ until a MRV system is in place which will serve to accurately monitor the emissions from deforestation /57/.

DNV GL has been tasked to verify the results in deforestation and forest degradation as measured using the Interim Performance Indicators established in the Joint Concept Note, specifically as outlined below and as detailed in the JCN Table 2, pages 22-28 /57/:

- Gross Deforestation in the period from 1 January 2015 to 31 December 2016 - Year 6;
- Loss of intact forest landscapes;
- Forest Management;
- Carbon loss as indirect effect of new infrastructure;
- Emissions resulting from illegal logging activities;
- Emissions resulting from anthropogenically caused forest fires;

## 3 BASIS OF VERIFICATION

In order to verify the Interim Performance Indicators, DNV GL has followed the principles and requirements for verifying GHG inventories and validating or verifying GHG projects defined by ISO 14064-3 /18/. This standard has served as guidance for the definition of the verification plan but it is important to note that this is not an accredited verification applying ISO 14064-3.




*ISO 14064-Part 3: Specification with guidance for the validation and verification of greenhouse gas assertions*

### 3.1 Level of assurance

According to ISO 14064-3, the level of assurance is used to determine the depth of detail that a verifier designs into their validation or verification plan to determine if there are any material errors, omissions or misrepresentations /18/. There are two levels of assurance, reasonable and limited. The level of assurance affects the relative degree of confidence the verifier requires in order to make a conclusion /18/ and the wording in the validation or verification statements.

For a reasonable level of assurance, the validator or verifier provides a reasonable, but not absolute, level of assurance that the responsible party's assertion is materially correct /18/.



A limited level assurance is distinguishable from a reasonable level of assurance in that there is less emphasis on detailed testing of data and information supplied to support the assertion /18/.

The verification team has designed the verification plan in order to attain a reasonable level of assurance in the verification of the Interim Performance Indicators.

### 3.2 Objectives

The objective of the verification is to provide stakeholders with a professional and independent verification of the results reported in the Guyana REDD+ Monitoring Reporting and Verification System (MRVS) - Interim Measures Report (IMR) (Version 3) on deforestation and forest degradation as measured using the Interim Measures Indicators.

This includes:

- Methodology validation; conformance of the analysis methodology and the monitoring system in place against applicable validation/verification criteria;
- Verification that the validated methodology has been followed to obtain the reported results;
- Verification of the results of the Interim Performance Indicators reported in the IMR;
- Verification that the comments from stakeholders have been taken into account in the IMR;

### 3.3 Criteria

According to the ISO14064-3 the validation/verification criteria would be the “policy, procedure or requirement used as a reference against which evidence is compared” /18/. Therefore, the validation of the analysis methodology and the verification of the reported results would be done against these criteria:

- Validation criteria
  - Main Criteria - Joint Concept Note (i.e. Section 3: REDD-plus Performance Indicators) /57/;
  - GOFC-GOLD REDD Source Book, 2014 /58/;
  - 2006 IPCC Guidelines /59/;
  - Approved REDD methodologies under the VCS programme /68/;
  - Peered reviewed publications /65/

### 3.4 Scope

According to ISO 14064-3, in determining the validation or verification scope, the validator or verifier should consider the extent and boundaries of the validation or verification process /18/. Taking into consideration the Terms of Reference (TOR) of the assignment /63/ and the provisions of the JCN /57/, the scope of the verification consists in the verification of the following deforestation and degradation Interim Measures Indicators as described in the JCN /57/:



Report Measure	Measure Ref	Indicator
Deforestation Indicators	1	Indicator 1: Gross Deforestation rate
Degradation Indicators	2	Indicator 2.1: Loss of intact forest landscapes
	3	Indicator 2.2: Forest Management (i.e. selective logging activities in natural or semi natural forests)
	2b	Indicator 2.3: Carbon loss as indirect effect of new infrastructure.
	4	Indicator 2.5: Emissions resulting from illegal logging activities.
	5	Indicator 2.6: Emissions resulting from anthropogenic forest fires.
	6	Indicator 2.4: Emissions resulting from subsistence forestry, land use and shifting cultivation lands (i.e. slash and burn agriculture)
	7*	Indicator 2.7: Encouragement of increasing carbon sink capacity of non-forest and forest land.

Furthermore the specific verification scope for these indicators is:

- *Geographical boundaries:* Guyana
- *Organizational boundaries:* Guyana Forestry Commission (GFC)
- *Physical infrastructure, activities, technologies and processes of the organization:* GFC Geographic Information System and Wood Chain of Custody System.
- *Time period(s) to be covered:* Monitoring period: Year 6 (1 January 2015 to 31 December 2016)
- *Frequency of subsequent verification processes:* Yearly verification
- *Intended user for the verification statement:* Government of Norway and Government of Guyana

### 3.5 Materiality

According to ISO 14064-3 materiality is the "concept that individual or the aggregation of errors, omissions and misrepresentations could affect the assertion and could influence the intended users decisions" /63/. The concept of materiality is used when designing the validation or verification and sampling plans to determine the type of substantive processes used to minimize risk that the verifier will not detect a material discrepancy /63/.

In order to be consistent with the stated level of assurance, a verification plan and an intensive sampling plan have been designed to minimize risks that a material discrepancy would not be detected.

\* Indicator 2.7 was reported for the first time by the Guyana Forestry Commission during Year 5, but is not part yet of the performance assessment. DNV GL assessed the accuracy and methodology as part of the overall system improvement process.

No level of materiality has been fixed so any individual or aggregate errors, omissions and misrepresentations that can be quantified which result in discrepancies have been considered as material and requested to be corrected.

## 4 METHODOLOGY

The verification of the results has assessed all factors and issues that constitute the basis for the interim measures indicator's results. These include:

- i) Guyana REDD+ Monitoring Reporting and Verification System (MRVS) - Interim Measures Report /1/;
- ii) Geo-database with all the raw and processed datasets /2/;
- iii) Database of wood harvesting declarations of wood extraction activities in lands classified as State Forest /5/;
- iv) Database of wood harvesting declarations of wood extraction activities in lands classified as Amerindian or Private Property /6/;
- v) Database of Procedural Breaches for the four forestry divisions of Bce, Dem, Ess and Nwd /4/;
- vi) Database of Illegal logging activities for the four forestry divisions of Bce, Dem, Ess and Nwd /3/;

### Verification team

Role	Last Name	First Name	Country	Type of involvement					
				Desk review	Site visit	Reporting	Supervision of work	Technical review	Sectoral competence
Team leader	Aalders	Edwin	Norway						
Independent Expert	Schut	Vincent	The Netherlands						
Validator	Reed	Pablo	United States of America						
Internal Technical Reviewer	Kapambwe	Misheck	Australia						

### Duration of verification


Preparations: From 01 February 2018 to 14 February 2018

On-site verification: From 15 February 2018 to 22 February 2018

Reporting, calculation checks and QA/QC: From 22 February 2019 to 20 April 2018

### 4.1 Review of documentation

In order to define the verification and sampling plan the verification team performed a review of all the documentation provided. This included the revision of the Interim Monitoring Report /1/, and also a desk review of the GFC's database with all the raw datasets and the processed datasets /2/. The verification team also reviewed the Standard Operating Procedures (SOP) followed by the GFC for the forest monitoring and the issuance of various permits



/19//20//22//23//24//25//26//27//28/. This served to detect the process operations with the highest levels of risk of material discrepancy, and to consequently design the verification and sampling plan on the basis of this information.

## 4.2 Site visit

An on-site assessment was performed from 15 February 2018 to 22 February 2018; partly in GFC's main headquarters located in Georgetown, and partly in GFC's forest stations of Bartica and Iteballi, as well as the base camp of current operations for the Willems Timber Field concession adjacent to Bartica, and the mining areas west of Bartica.

After the definition of the final verification and sampling plan, the actual verification on-site assessment was performed. During these days two different verification teams were created to focus on specific indicators:

Team 1 – remote sensing and GIS: This team carried out the verification of the Indicators 1, 2.1, 2.3, 2.4, 2.5 and 2.6. This verification took place in GFC's GIS office and by on-site verification in the area around Bartica

Team 2 – forest management and illegal logging: This team carried out the verification of Indicators 2.2, 2.5 and 2.6. A verification of GFC's databases was carried out on the first and last day of the audit, which helped cross reference and spot-check documentation and procedures with the GFC's forest stations in the field, Bartica and Iteballi, as well as with the Willems Timber Field forest concession across the river from the port city of Bartica. Beyond the cross-checking of information and procedures, interviews with respective staff and/or stakeholders were also carried out.

On 22 February 2018 a closing meeting with a preliminary reporting of the findings of the verification took place in the GFC's headquarters.

## 4.3 Reporting of findings

A major corrective action request (MAJOR) is issued, where:

- i. the evidence provided to prove conformity is insufficient;
- ii. mistakes have been made in applying assumptions, data or calculations which could have a material influence on the results;
- iii. non-compliance with relevant criteria;

A minor corrective action request (MINOR) is issued where:

- i. the evidence provided to prove conformity is insufficient but does not lead to breakdown in the systems delivery;
- ii. mistakes have been made in applying assumptions, data or calculations which could have an influence on the future results;
- iii. if a certain aspect has to be verified in the next verification event (e.g. foreseen modifications, etc.)

An observation shall be raised by the team as a team's recommendation in relation to future improvements of the analysis process or the monitoring of the interim measures indicators.

During the audit the team can also raise a clarification request (CL) when it has found that information is insufficient or not clear enough to validate or verify against applicable criteria.

The results are discussed in Chapter 5 and findings are listed in Appendix A.

## 5 MAIN PART OF THE REPORT

### 5.1 Interim indicator 1 - Gross Deforestation

#### 5.1.1 Methodology validation

##### a Methodology description

For Year 6, the GFC has switched from RapidEye to ESA's Sentinel-2 satellite imagery for the deforestation mapping. Sentinel-2 data being free of charge, this is in line with the commitments made by Norway and Guyana in MRVS Phase 2 (Year 2015 – Year 2019) that Guyana should look into non-payment options. Also, it enabled GFC to continue mapping while a new agreement with Norway was being worked on without the need to pay for pre-ordering ('scheduling') of RapidEye data.

This switch means a slight decrease in spatial resolution: RapidEye's resolution is 6.5 m (resampled to 5m/pixel) while the resolution of the relevant spectral bands of Sentinel-2 is 10m.

Spatial accuracy and co-registration of Sentinel-2 imagery is considered very good, and was found to be better and more consistent than RapidEye.

Additionally, Landsat-7 and Landsat-8 imagery (30m resolution) was used, to fill in for persistent-cloud areas in the Sentinel-2 imagery, and to more precisely pinpoint the time of change for deforestation events.


For the deforestation mapping, wall-to-wall coverage was acquired for Sentinel-2, Landsat-7 and Landsat-8 imagery, from August to December 2016, resulting in multiple acquisitions per location from each sensor. In total, 139 Landsat and 84 Sentinel-2 images were acquired and used.

Ancillary FIRMS (MODIS) fire hotspot data were acquired and used to aid in the classification of areas deforested due to fires.

DNV GL has observed that the Year 6 processing and mapping is largely the same as in Year 5. However, due to time pressure in the step to generate the EVI and create change polygons was omitted. In previous years, these change polygons were used to guide the manual mapping of new deforestation events. In Year 6, the mapping of deforestation events has been done without these intermediate polygons (see 5.4.1). In addition to the available spectral bands, an NDVI (Normalized Difference Vegetation Index, comparable to EVI) band was calculated and added to the visual mapping process.

The mapping process was, as in previous years, based on 24x24km tiles, which were assigned at random to the mapping operators. Within each 24x24km tile, sub-tiles of 1x1km were created, which were visited and processed tile by tile by the operator. Mapping is done manually, based on visual interpretation of images of the last months of 2016, compared with the previous deforestation map and with images of the years before. Within each tile, changes from forest to other land cover which are larger than the MMU of 1ha are mapped and the change driver is assessed and recorded. This whole process is facilitated by a custom-build ArcGis toolbar, which guides the process and has some built-in checks to prevent wrong or missing data to enter the database. After finishing one tile, the tile is handed over to QA/QC. After QA/QC, the tile is merged with the new basal year.

All mapping is done following specific mapping Standard Operating Procedures (SOPs) /8/, which ensures full consistency in the interpretation and data treatment. Considering this, training procedures in place, and the establishment of automatic operations in the processing change, it is



confirmed that enough Quality Control (QC) procedures are in place to provide reliable mapping results.

## **b Validation criteria and Indicators**

Criteria noted in the JCN /58/ requires: 1) assessment of the rate of conversion of forest area as compared to an agreed reference level; 2) forests are defined by Guyana in accordance with the Marrakech accords; 3) conversion of natural forests to tree plantations shall count as deforestation with full carbon loss; 4) forest area converted to new infrastructure, including logging roads, shall count as deforestation with full carbon loss; 5) forest cover on 1 October 2010 will be used as a baseline for monitoring gross deforestation; 6) reporting is to be based on medium resolution satellite imagery and in-situ observations where necessary; and, 7) monitoring shall detect and report on expansion of human infrastructure (e.g. new roads, settlements, pipelines, mining/agriculture activities etc.). The provisions made in the JCN /58/ were considered in the definition of the analysis methodology.

The verification team examined each area of the GIS and remote sensing methods used against recommended and suggested actionable criteria in the guidance documents (JCN /58/, GOF-C-GOLD REDD Sourcebook /59/, and 2006 IPCC Guidelines (GL) /60/ to validate the methodology for measurement of gross deforestation followed by the RP. Specific areas included: geometric correction, radiometric normalization, cloud-masking, forest/non-forest assessment, and mapping quality control and assessment. In addition, an independent accuracy assessment has been performed by the Durham University.

## **c Validation of methodology against criteria**


### Generation of deforestation datasets

The GFC follows a hybrid method of automated and manual mapping. Automated tasks are used for procedures that are largely independent of local image circumstances, and manual processing is used where automated processing would probably introduce errors due to inconsistencies in image characteristics, which automation often has difficulties to deal with. The main reason for using manual digitizing is the excess in cloud cover of the datasets which made it practically impossible to use automated methods as recommended in the GOF-C-GOLD REDD sourcebook /58/. However, the applied methods are in line with the GOF-C-GOLD REDD Sourcebook as they rely on multi-date imagery and focus on the forest change by updating forest cover maps of previous epochs (pre-classification). Furthermore, the GFC applied QA/QC measures through the establishment of SOPs, establishment of automatic operations, and revisiting of 100% of the 24 km x 24 km grid cells used for aiding the visual interpretation. The measures and approaches have been verified as having reduced the human error /1/.

### Independent accuracy assessment

Additionally, an independent accuracy assessment is conducted as a verification procedure as defined by the 2006 IPCC GL. The verification team checked the methodology followed for this assessment /17/. According to this document /17/, the accuracy assessment builds further on the Year 5 sampling design, in order to generate a reference change dataset. Using a reference change dataset instead of a new random sampling reduces the uncertainties in forest change estimates, and allows getting confidence intervals for the change estimates.

The Year 6 sampling design uses the same two-stage sampling with stratification on the primary units (being the GeoVantage flight strips of 5x15km). Due to uncertainty of financing during the Year 6 period, less costly alternatives for the Geovantage aerial images were evaluated. As result, PlanetScope images (provided by PlanetLabs) were used for the sample based change assessment.



These images have a resolution of 3.7m, which is comparable with the GeoVantage images used before. Spectral quality appeared to be less good, but good enough for the images to be useful.

For the High Risk and Medium Risk strata, 313 sampling units were revisited with PlanetScope imagery. For the Low Risk stratum repeat coverage Sentinel-2 was used.

The calculations for the Accuracy Assessment (AA) for Year 6 have all been implemented in R and the R survey package. R is an open source statistics package comparable to SAS (and a defacto academic standard). This in principle allows for a check by repeating the calculations, when GFC would decide to make the AA data and R scripts public, as the R software is freely available.

The methodology followed best practice guidelines in terms of sample design and accounting for national conditions and capabilities /58/.

### Conclusion

The verification team concludes that the analysis methodology used by the GFC meets the applicable criteria, defined by the JCN /57/, GOFC-GOLD REDD Sourcebook /58/, and 2006 IPCC Guidelines (GL) /59/.

## 5.1.2 Verification of Indicator

### Image processing

The verification team confirmed that the radiometric normalization technique used is the Dark Object Subtraction (DOS)/1/ and that it was adequately implemented. Cloud-shadow masking methods used 'thresholding' in the blue band and additional manual inspection. These methods are adequate and in line with the GOFC-GOLD REDD Sourcebook /58/. Least cloud cover Sentinel-2 input images were selected and geometric correction of images was considered adequate. Though the resolution of the Sentinel-2 images is slightly lower than the previously used RapidEye images, it is still considerably higher than the minimum of 30m as advised in the GOFC-GOLD REDD Sourcebook /58/, and certainly enough to allow reliable mapping of deforestation.


### Analysis methods

Deforestation in Year 6 was obtained through visual interpretation of Sentinel-2 images. Taking into account the fact that the same procedure was used for Year 5 and that an independent accuracy report /17/ has been produced confirming the accuracy of the mapping of RP, verification focused on conformance between the SOP (in this case: the mapping guide) and the actual mapping process. The verification team had checked the mapping process at several levels and mapping locations, and concluded that SOPs were followed and that the deforestation mapping was of a high quality. The verification team interviewed the operators and found their level of understanding of the processing and mapping tasks to be very good. It should be noted that operators are all local persons and GFC staff.

An Excel sheet was developed in Year 5 by Indufor to aid in the conversion from the GIS mapping output to the final figures according to IPCC standards. The creation of the IPCC tables in Year 6 is still done by Indufor personnel. It is envisaged to transfer this activity from Indufor to GFC in Year 7.

### Accuracy assessment

The verification team checked the results of the independent accuracy assessment performed by the University of Durham /17/ and provided by the RP. According to this assessment the annualized gross deforestation rate for Year 6 is 0.0548% (16 239 ha) with a standard error of 0.0064 (1 940 ha). This agrees with the reported annualized change rate by GFC, which is 0.05%.



The verification team has verified the results of the accuracy assessment by having the validation process demonstrated and checked. The verification team has interviewed some members of the accuracy assessment team from Durham University, and found their understanding and knowledge of the matter excellent.

### Conclusion

Taking into consideration all the findings obtained with the verification and sampling plan applied as stated above, and the final results provided for the independent accuracy assessment, the verification team considers that the validated methodology has been followed correctly and that reported results are free from omissions and misrepresentations that could lead to material misstatements.

The verification confirms the gross deforestation rate in Year 6 is 0.05%.

## **5.2 Verification of Interim indicator 2.1 - Loss of intact forest landscapes**

### **5.2.1 Methodology validation**

#### **a Methodology description**


The methodology followed by the GFC to prepare the Year 1 intact forest landscape (IFL) layer uses the existing global IFL GIS layer as a starting point and then buffers various P1, P2, P3, Year 1, Year 2, Year 3, Year 4 and Year 5 land use layers and excludes them /65/. Layers buffered and excluded are water bodies (including navigable rivers and shorelines), settlements and municipalities, agricultural concessions, and deforested areas. The deforested areas had been pre-selected to contain forestry roads, infrastructure roads, mining, and/or mining roads /65/. Forestry concessions were also extracted and are considered as logging at an industrial scale, though at low intensity. Once the deforested areas have been removed, the polygons allowed to remain in the resulting GIS layer will be larger than 50 000 hectares and capable of enclosing a circular object of 10 km radius. An assessment is made to ensure that at least a 2 km wide corridors or appendages are observed to and from areas meeting the applicability conditions. All of the buffering, exclusion, area calculation, and area-based selection are performed using ArcGIS v.10 modeling code /65/. Final identification of polygons meeting suitable width criteria is performed manually. Furthermore, in order to refine the IFL map and according to the official IFL technical definition, cleanup of island polygons which measure less than 10 km at the broadest place, or less than 2 km at corridors or appendages was performed.

The GFC has included this operation in their procedures, though still as a manual post-processing operation. Given the fact that this operation involves only 9 large and non-complex polygons, the manual character of the operation is not deemed a source of potential material misstatements. The audit team has verified the IFL map creation and concludes that it meets the applicable criteria and that the manual post-processing is conducted in adherence to the SOP.

#### **b Validation criteria and Indicators**

Criteria used to validate this landscape methodology included the existence of appropriate input data layers, and defined prerequisite processes for estimation (buffering and exclusion from the input layers) were sourced from Potapov *et al.* (2008) /66/, as referred by JCN /57/. The JCN specifically states that “*the total area of intact forest landscapes within the country should remain*





*constant. Any loss of intact forest landscapes shall be accounted as deforestation with full carbon loss". Potapov et al. also suggests that monitoring and estimation should use similar methods as for forest area change estimation. A footnote defines IFL "as a territory within today's global extent of forest cover which contains forest and non-forest ecosystems minimally influenced by human economic activity, with an area of at least 500 km<sup>2</sup> (50 000 ha) and a minimal width of 10 km (measured as the diameter of a circle that is entirely inscribed within the boundaries of the territory)." Potapov et al. /66/ had an additional size criteria stating that corridors or appendages to areas that meet the aforementioned spatial conditions must be at least 2 km wide.*

Potapov et al. /66/ did their seminal work with a historical series of Landsat images, and wrote that construction of the IFL layer should start with the study area and then systematically identify and eliminate locations of human development. The specific areas of human influence that should be eliminated are: 1) settlements; 2) infrastructure used for transportation between settlements or for industrial development of natural resources, including roads (except unpaved trails), railways, navigable waterways (including seashore), pipelines, and power transmission lines; 3) areas used for agriculture and timber production; and 4) areas affected by industrial activities during the last 30-70 years, such as logging, mining, oil and gas exploration and extraction, peat extraction, etc. /66/. Buffers of 1 km were applied to settlements and transportation infrastructure. Burned areas from forest fires causing stand-replacing wildfires in the vicinity of infrastructure or developed areas should be eliminated.

### **c Validation of methodology against criteria**

The verification team concludes that the analysis methodology used by the GFC meets the definition and concept of Intact Forest Landscape /67/ and is in line with the recommendations of Potapov et al. /66/.

## **5.2.2 Verification of Indicator**

The methodology of verification used by the verification team examined the existing GIS layers; spatial modeling code used by the RP, and output layers and had the operator demonstrate the procedure step by step.

The verification team concludes that the calculation of IFL is correct and, that the corrected benchmarks IFL figure for Year 6 is 7 604 024 ha. As at Year 6 there was a loss in IFL area of 796 ha which relates to an annual loss of 290 ha, with 63 ha of that being accounted for by newly titled Amerindian land.


## **5.3 Verification of Interim indicator 2.2 - Forest Management**

### **5.3.1 Methodology validation**

#### **a Methodology description**

During Year 6, the GFC has continued their unique approach to sustainable forest management and continue to enact a robust forest monitoring system, which still holds enforcement of forest legality amongst its main objectives /8/. The forest legality procedures and mechanisms continue to be a direct result of years of experience and are still governed by the same series of guiding documents and legislation as in previous years, mainly the country's Forestry Act, the National Forest Policy and Plan, and the Guyana Forestry Commissions' Work Plan. At the time of this verification, the monitoring division of the GFC still consists of approximately just over 200 staff, spread out over the head office personnel in Georgetown, 4 divisional stations, 39 field stations, and 10 mobile stations.





With regards to the Forest Management Interim Indicator 2.2, the most relevant aspect of the RP's forest monitoring system remains its four main components to enforce forest legality:

- Forest Concession Monitoring: This part of the monitoring system consists of the monitoring of the concessions from a legal point of view (i.e., permitting, payment of royalties,...) and the strictness of the forest management activities performed by the concessionaires;
- Monitoring of forest produce in transit: This is the Chain of Custody (CoC) system that has been implemented in Guyana since the year 2000 /8/. This CoC system, of which the Log Tracking System is a main part, has as the main objective to verify the origin of raw material and to control the level of harvesting within State Forests /8/;
- Sawmills and Lumberyards monitoring: This component consists of the verification of the legality of sawmills and Lumberyards and their operation /22/.
- Exports: This component of the monitoring system seeks to control all exportations and to check the legality of the produce to be exported .

As in Year 1, 2, 3, 4 and 5, all data used to calculate the Interim Indicator 3 for Year 6 is sourced from the monitoring of the forest produce in transit or CoC component of the RP's monitoring system, and the verification has therefore concentrated on these aspects of monitoring.

The existing CoC system provides detectable evidence on the legitimacy, location and magnitude of forest operations in Guyana, and is currently applied to all forestry operations, including state forests, Amerindian reservations, as well as private properties. The system is based on the traceability of forest produce through the use of log tracking tags, which are assigned to all concessionaires and private forest holders who are involved in commercial logging operations in a given year. Log tagging is done at the stump, where half of the tag is affixed to the stump at the time of felling, and the other part of the tag bearing the same sequence of numbers as recorded on the stump tag is affixed to the produce being removed and transported. This procedure is carried out for all types of forest produce, including logs, lumber piles, poles, and posts. The unique identification code on each unit of produce will indicate who the concessionary operator is, and can therefore help indicate the geographic origin of the forest produce. In addition, the tagging systems is linked to a quota system, where information is gathered in order to control the volume of produce being harvested from a given area, and which is calculated based on the assigned sustainable yield of the forest area in question and which also considers variables such as felling cycles, felling distances, and minimum girth requirements /8/.

The link between the tagging system and the produce information (e.g. origin, destination, volume, type of produce) is done through volume declarations, which are included within the removal permit records emitted by the RPs.

The monitoring process of the extracted volumes varies depending on whether the operation:

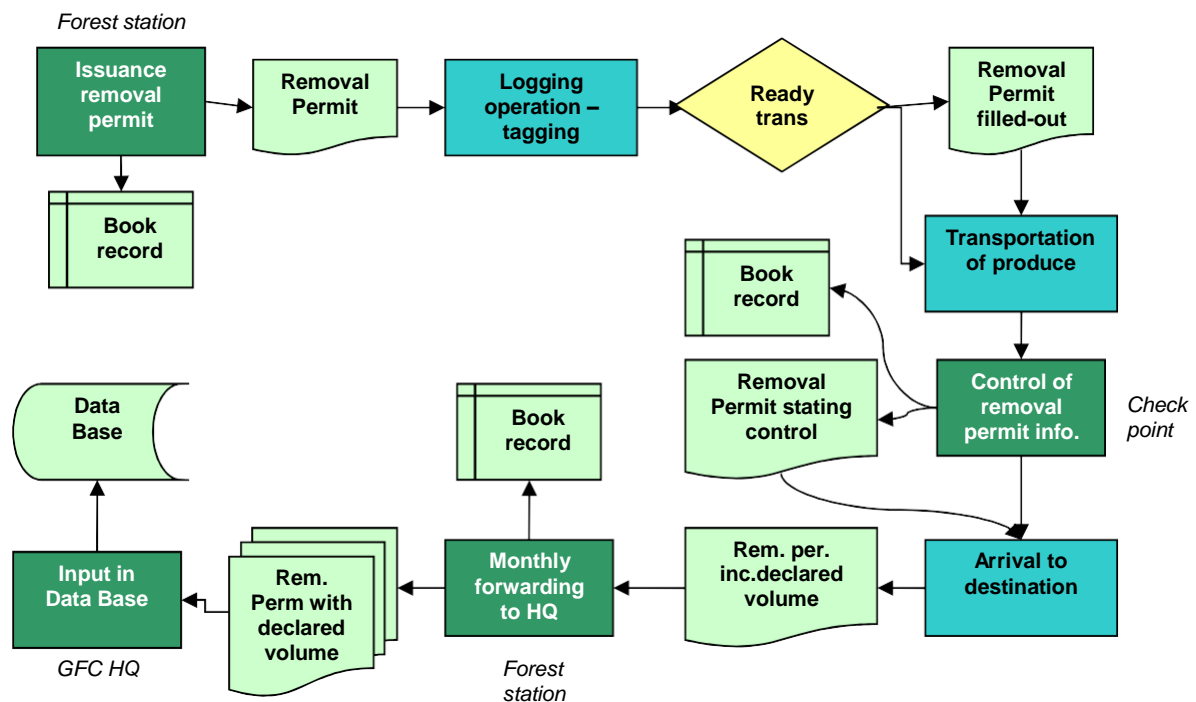
- Takes place in a State Forest lands and is not a procedural breach;
- Takes place in the private properties / Amerindian lands and is not a procedural breach;
- It is a procedural breach (i.e. State Forest lands or private properties / Amerindian lands);
- It is illegal logging.

The forest monitoring is implemented with written standard procedures which are now in place for each of these instances, as DNV-GL was able to confirm once more.

#### State Forest Lands

The monitoring process for extracted volume from State Forest Lands remains the same as reported in Year 1, 2, 3, 4 & 5 verification /70//71//72//73//74/. The operator has to request for the issuance of a removal permit in any of the existing forest stations /8/ (Figure 3) before the logging operations commence. The removal permit will be filled-out with the operator's details. Each forest station records the issuance of the removal permit in specific books and through

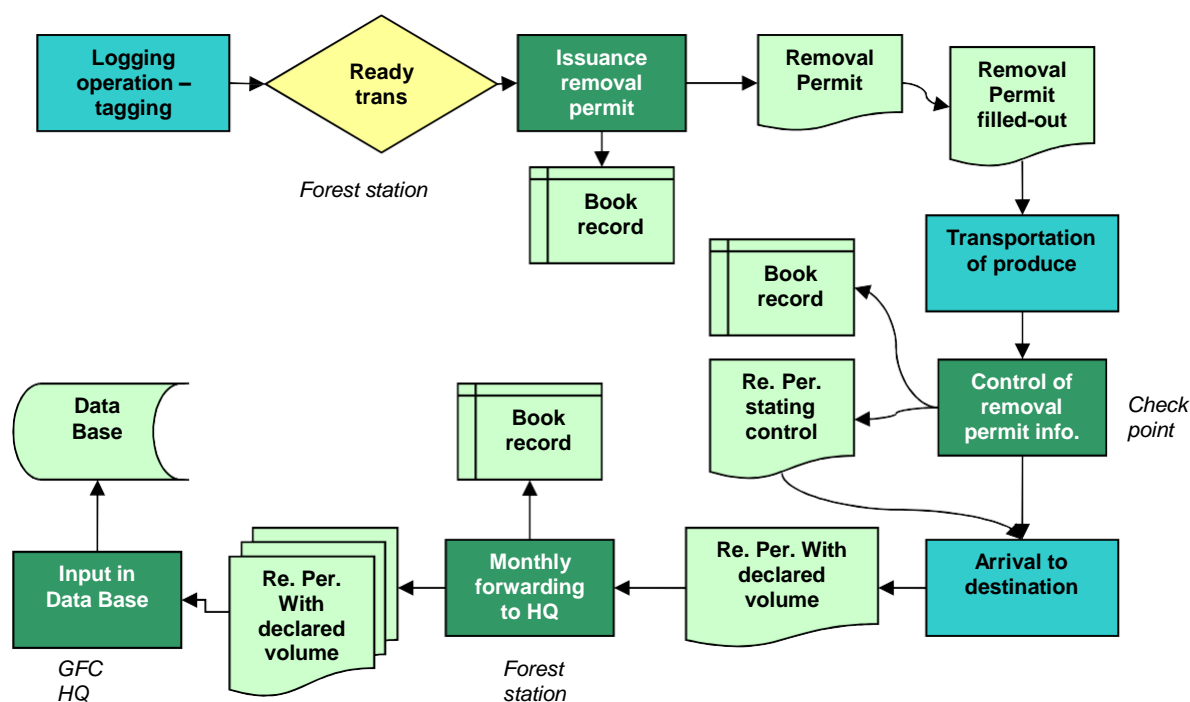
approval letters emitted from the central office in Georgetown /20//29//30/37/. Once the operator is ready to transport forest produce beyond their regularized boundaries, they are required to complete the removal permit, stating the date of removal, destination, vehicle type, vehicle identification, name of driver/captain, specification of forest produce and associated tags (tags must be listed according to species and product type), volume and total tags used and any other pertinent information /8/. As part of the QA/QC measures set in place, the produce transported and the correctness of the respective removal permits are checked and verified at various GFC strategically located checkpoints. This check is recorded in books stating the removal permit license, the type of produce, volumes and date when the removal permit and the produce were checked. The issued removal permits are valid only for 30 days, and once the produce has reached the destination, concessionaires would have to declare the volume to the nearest forest station within 24 hours /8/. Every month, these removal permits are sent to the GFC's headquarters to be recorded in a specific database. Specific QA/QC measures are in place to assure that the recording errors are reduced to a minimum (i.e., by using formulae that check the consistency of data, regular consistency checks, restricted access to the database, etc.) /20//29//30/37/.



**Figure 3. Monitoring process flow chart – State Forest Lands**

Private Properties / Amerindian lands:

As in previous verification years 1, 2, 3, 4 & 5, the owner is not required to request a removal permit before the logging commences when this occurs in private or Amerindian lands. However, the supposed owners of the logging produce are required to have a removal permit filled-out in any instance that the produce is to be transported outside the boundaries of the property (Figure 4). From that point forward, the monitoring system is similar to that of the State Forest lands.




**Figure 4 Monitoring process flow chart - Private Properties/Amerindian lands**

Procedural breach or an illegal logging breach

As in previous verification years, in case the operator does not have a removal permit or a removal permit has inconsistencies, the amount removed is then recorded respectively into the Illegal Logging Database or in the Procedural Breaches Database /28/. In the case it is demonstrated after investigation that a certain operation is not considered illegal logging or a procedural breach, the respective record is then cancelled from this database and is added to the State Forest or private property/Amerindian databases. As is the case with the state forest database, volumes are reported to the data base according to species as well as to the type of product identified and deemed as "illegal" or a "procedural breach", which may be any of the following: charcoal; firewood, logs, lumber, piles, poles, posts, and spars.

The reported results of the interim performance indicator for Year 6, as in previous years, are therefore the total volume extracted in tCO<sub>2</sub> (expressed as Cubic Meters (CBM)) obtained from all the removal permits (or estimations by the authorities in case no removal permit is present) recorded in the four data bases: Forest state lands; Amerindian and private properties; Illegal logging database; and Procedural breaches database. In the case of Logs and Sawn-wood, values reported by the GFC officer reporting the illegal activity are divided by 0.7852 and 0.5 respectively, as the declared volume is not the real volume felled, but the commercial volume extracted /3//35/.

In 2011 & 2012, the GFC made progress towards developing a methodology and factors that relate total carbon emissions from biomass damage due to logging activities (collateral damage) to the volume of timber extracted. This has been achieved through a technical report by Winrock International (S. Brown et al. 2011) for the GFC: Collateral Damage and Wood Products from Logging Practices in Guyana, December 2011 /7/ and the guiding document: Guyana Forest Carbon Monitoring System: Emission Factors and their Uncertainties, Version 2. June 2014 /13/. The methodology applies the logging damage factor (0.95 tC/m<sup>3</sup>), wood density of commercially harvested timber (0.38 tC/m<sup>3</sup>/gap), logging infrastructure factor (skid trails, etc.) (32.84 tC/km



and the conversion factor for tC to tCO<sub>2</sub> in the conversion of total volume in CBMs to tCO<sub>2</sub>, and also includes storage in long term wood products /7/. Total carbon stock in long-term wood products was estimated from the extracted biomass carbon using Winjum et al 1998 formula and the approach in the approved VCS Module VMD0005 /69/, which DNV GL cross-checked and confirmed. This computation was based on all extracted wood biomass (including exports) captured by GFC's records and databases during the period 1 January 2015 to 31 December 2016 (i.e. Year 6) with the data available of the total wood volume harvested during this period.

## **b Validation criteria and Indicators**

According to the Joint Concept Note (JCN) on REDD+ cooperation between Guyana and Norway /57/ one of the degradation indicators deals with forest management (i.e. selective logging) activities in natural or semi-natural forests:

- *"All areas under forest management should be rigorously monitored and activities documented (i.e. concession activities, harvest estimates, timber imports/exports)."*
- *"Increases in total extracted volume (as compared to mean volume 2003 – 2008) will be accounted as increased forest carbon emissions unless otherwise can be documented using the gain-loss or stock difference methods as described by the IPCC for forests remaining as forests. In addition to the harvested volume, an appropriate expansion factor of 25% (applied to the hole population of trees under forest management, i.e. harvested + remnant trees) shall be used to take account of carbon loss caused by collateral damage, etc., unless it is documented that this has already been reflected in the recorded extracted volume."*

According to the JCN, the way monitoring and estimation of the indicator shall be done is through *"Data on extracted volumes collected by the Forestry Commission. Independent forest monitoring will act as an additional data source on forest management to complement this information. Accounting of this indicator should be done in terms of carbon units referred as close as possible to extraction of biomass from the above ground carbon pool."* /57/.

In line with the findings during the first, second, third, fourth, and fifth verifications /70//71//72//73//74/ it is understood that this would imply that the extracted volume makes reference to the total biomass removed from the above-ground carbon pool, which is closer to giving a reference on the forest degradation than the commercial volume harvested. Therefore, the methodology has once more been considered to take this provision into account.

## **c Validation of methodology against criteria**

In order to validate the methodology followed and the monitoring system in place, the verification team carried out a process-based assessment similar to Years 1-5. This involved spot check verifications of respective documentation and data operations for the following respective monitoring process:

- Legal Concession Agreements
- Boundary Demarcations
- Forest Management Plans – Inventories, Initial Business Plans
- Annual Operational Plans – Stock Maps, planned Infrastructure, etc.
- Quota System Adherence
- Log tracking and tagging
- Removal Permitting
- Production Register
- Licensing – Sawmill, Timber Dealer, Export
- Code of Practice adherence
- Data Procedures

- Primary Collection
- Intermediate/secondary data collection
- Recording and storage of data bases (main and field offices)
- Reporting (from field office to main office, other stakeholder reports)
- QA/QC procedures for data collection, intermediate data recording, data recording in the main data base, procedures for data reporting.

For each of these operations, the verification team checked the training of personnel /29//30/37/54//55//56/ via interviews, which checked the GFC staff's knowledge of the procedures in place. Furthermore, the verification team also performed spot checks of removal permits and other relevant information in order to verify the consistency of the same in each database, with the information in the removal permit (or illegal logging forms) and with the records available at the transit & forest stations of Bartica /56/ and Iteballi /54/, and with personnel at one of the field offices for the Willems Timber Field Forestry Concession near Bartica /56/.

The GFC demonstrated the knowledge of the procedures in place, and no evidence was identified that could lead to believe that the monitoring system is not robust. The staff were well trained and during the audit demonstrated great level of involvement and dedication to implementing the procedures.

The continuous data that has stemmed from the work that the GFC and Winrock have done has continued to show a high level of consistency and predictability on the level of damage and impacts per cubic meter harvested, as does the RP's adherence to the methodology to determine carbon stored in long-term wood products.

In view of the above, the verification concludes that the analysis methodology used by the GFC meets provisions of the JCN /57/.

### 5.3.2 Verification of Indicator

In order to verify the reported assertions of Indicator 3, the verification team performed the following checks:

- Consolidation, calculation and reporting: Confirmation that the total reported in the database is consistent with the figure reported in the IMR;
- Recording: Database records were randomly chosen and data was compared with the hard copy documents;
- Collection: Cross-checking hard copy records and books located in the Iteballi and Bartica Transit/Forest stations through interviews with personnel at one of the field offices for the Willems Timber Field Forestry Concession near Bartica. All data obtained from forest station and concession visits was further cross-checked against the respective database records.
- Calculation: DNV GL checked the database spread-sheets in the Forest Resources Management Division's REDD Secretariat and can confirm that the calculations embedded in the tool for estimating emissions and removals due to timber extraction reflected those described in the Interim Monitoring Report and the VCS Module VMD0005 /69/.

The verification team did not detect any discrepancy that the reported assertions on Interim indicator 3 - Forest Management is equal to 1 892 371 tCO<sub>2</sub>.

## 5.4 Verification of Interim indicator 2.3 - Carbon loss as indirect effect of new infrastructure

### 5.4.1 Methodology validation

#### a Methodology description

In Year 6, the methodology to calculate the loss of carbon as an indirect effect of new infrastructure ('degradation') has changed from a wall-to-wall mapping approach to the sample based approach which was used as an independent accuracy assessment in previous years. The results of this sample based estimate have proven to be consistent with the results of the wall-to-wall mapping based approach in previous years.

The estimation methodology has been developed and refined by Durham University during the previous years as part of the accuracy assessment. In Year 6, the degradation estimation has still been conducted by Durham, because the approach had not yet been integrated into the workflow of GFC. Because the result of this estimation is now a primary figure instead of an accuracy check, the audit team deemed it necessary that knowledge transfer and capacity building should take place, so GFC can do the estimation.

Transfer to GFC as part of the CAR3 implementation that was raised during the audit specific training by the Durham University is foreseen (CAR 3).

Because in Year 6 there was no degradation figure from the wall-to-wall mapping, the degradation estimate from the accuracy estimate was promoted to be the main figure. There was no second figure which could serve as an independent accuracy assessment of the degradation estimates. However, taking into account the agreement between both the degradation figures from the wall-to-wall mapping and the sample based approach in the previous years, the team from DNV-GL has no reasons to assume a sudden material disagreement in Year 6. Once the procedure has been transferred to GFC staff, Durham can again be tasked with doing an independent estimate. The DNV-GL team has raised 2 major CARs related to this: CAR 2 on the fact that the mapping SOP is not yet in line with the current practice, and CAR 3 on the fact that a proper accuracy assessment is missing for the degradation estimate.


#### b Validation criteria and Indicators

The main validation criteria is the JCN /57/ guidance document, as there are no other criteria listed in other guidance materials specific to detecting degradation from establishment of transportation infrastructure. Interpretation and mapping of new mining and roads related to mining, forestry, and infrastructure use the same methodology and criteria for verification found in the estimation of gross deforestation (see Section 4.1).

The JCN /57/ notes that the establishment of new infrastructure in forest areas often contributes to forest carbon loss outside the areas directly affected by the constructions. "It calls for detection of degradation in a 100m buffer surrounding new infrastructure (including mining sites, roads, pipelines, reservoirs, etc.) and applies a benchmark of a degradation area of 4 368 ha. Any degradation above this benchmark for the years after Year 2 will lead to a reduced compensation and unless other emission factors can be documented through the MRVS, these areas shall be accounted with a 50% annual carbon loss through forest degradation." Apart from this criterion, the recommendations made by the GOF-C-GOLD REDD Sourcebook /58/ for mapping of degradation would also be applicable.

#### c Validation of methodology against criteria

The GFC has fully adopted the degradation criteria agreed upon in the JCN. A degradation estimate is based on manual interpretation of very high resolution imagery (GeoVantage aerial and



PlanetScope satellite), starting within a buffer of 100m from the outside edge of existing infrastructure. The used sample and methodology have proven to be representative and deliver similar figures as a wall-to-wall mapping approach. The verification team has checked the degradation and reporting by the Durham team, and has found the degradation estimation to be consistent with the SOP.

The verification team concludes that the analysis methodology used by the GFC meets provisions of the JCN /57/ and that the degradation estimation using a sample-based approach to manual interpretation of very high resolution images is accurate and representative for the whole country.

## 5.4.2 Verification of Indicator

The verification team had the GIS operators re-map the degradation for several areas and compared the results with the initial degradation polygons. Based on its findings the verification team concludes that the mapping of degradation is done correctly and conform to the mapping SOP/15/.

The verification team interviewed the GIS operators about their understanding of the degradation mapping method and concludes that the GIS operators are following their procedures /15/ and understand the reasoning behind it.

Additionally, the verification team checked the final results of the independent accuracy assessment performed by the University of Durham /17/ and provided by the RP. According to this assessment the overall accuracy of the Year 6 degradation mapping would be equal to 99.98% (97.69% in Year 3), which would confirm the acceptable accuracy of the mapping according to the REDD sourcebook /58/ and to other applicable criteria /67//68/. The verification team has verified the results of the accuracy assessment by having the process being demonstrated and checked for one (1) validation tile, and by inspecting and running the R scripts used to calculate the final accuracy values.

As a result, the verification team concludes that the Year 6 method conforms to the JCN requirements, and concludes that the value for Indicator 2.3 for Year 6 is equal to 5 679 ha.

## 5.5 Verification of Interim indicator 2.4 – Emissions resulting from subsistence forestry, land use and shifting cultivation lands (i.e. slash and burn agriculture)


### 5.5.1 Methodology validation

In line with the JCN /57/ this indicator is presently not monitored till the full MRV is in place. GFC has however like the previous year started to develop a methodology for measuring and reporting of this indicator. Areas of shifting cultivation which previously were mapped but not considered in the overall assessment are since 2013 being labeled in a manner that will allow tracking the specific changes overtime within the GIS system from Year 4 audit onwards. Shifting cultivation areas are either labeled as pioneer, when they appear to occur as a newly cut area within an area which was seen as high forest in the previous year, or as rotational, when found within a historical degraded and impacted area. All areas larger than 0.25 ha are being mapped and tracked.

The main validation criteria would be the GOFC-GOLD REDD Sourcebook /58/ as the JCN /57/ guidance document does not provide any guidance. The JCN only states that this indicator is not relevant for the interim period before a proper MRVS is in place.

The GFC has fully adopted the degradation mapping method agreed upon in the JCN. Degradation is manually mapped using high-resolution imagery. The verification team has checked the





degradation and reporting in their GIS systems, and has found the degradation mapping to be consistent with the mapping SOP.

The verification team concludes that the analysis methodology used by the GFC meets provisions of the GOFC-GOLD REDD Sourcebook /58/.

## 5.5.2 Verification of Indicator

During Year 4, the audit team raised CAR 4 in relation to the stratification of the biomass plots to determine biomass for shifting cultivation. During Year 5, GFC initiated the corrective action work to collect the respective data. However due to the delays in the start of the Phase II of the Guyana and Norway REDD agreement, priorities shifted during the Year 6 period towards impacts of the new satellite images on GFC ability to identify land use changes in line with the requirements of the JCN as well as GFC's own needs. Consequently, no progress was made in the re-stratification work, the verification team agreed to leave the CAR open to allow more research and fieldwork on the issue.

The verification team assessed GFC ability to identify the areas to be subject to shifting cultivation using the Sentinel-2 imagery in combination with the historic images of the previous years and did not detect any discrepancy that the reported assertions on Interim indicator 6 – Emissions resulting from subsistence forestry, land use and shifting cultivation lands was 93 ha/yr.

## 5.6 Verification of Interim indicator 2.5 - Emissions resulting from illegal logging activities

### 5.6.1 Methodology validation

#### a Methodology description

The monitoring of illegal logging is within the main objectives of the forest monitoring system described in Section 5.3.1 a, as the monitoring system serves to enforce legality. Cases of illegal logging are found in the course of routine/impromptu operations performed by the GFC staff or through information of these occurrences by stakeholders. In the case where investigation demonstrates that a certain operation is not considered illegal logging or a procedural breach, the respective record is cancelled from the illegal logging database and is added to the State Forest or private property/Amerindian databases.


#### b Validation criteria and Indicators

According to the Joint Concept Note (JCN) /57/ one of the degradation indicators has to cover illegal logging activities:

- "Illegal logging results in unsustainable use of forest resources while undermining national and international climate change mitigation policies"
- "Areas and processes of illegal logging should be monitored and documented as far as practicable"

The JCN specifies the way the Indicator has to be monitored and estimated: "*The monitoring of illegal logging is within the main objectives of the GFC's forest monitoring system, and is informed by an illegal logging database. In addition to reporting on illegal logging via the database, Independent Forest Monitoring will support performance monitoring of forest legality through the IFM framework. Should IFM detect potentially significant challenges with the established forest monitoring system, this indicator will be reassessed. In the absence of hard data on volumes of illegally harvested wood, a default factor of 15% (as compared to the legally harvested volume) will be used. This factor can be adjusted up- and downwards depending on documentation on illegally harvested volumes, inter alia from Independent Forest Monitoring*". Furthermore, it states





that another means of monitoring should include “*Medium resolution satellite to be used for detecting human infrastructure and targeted sampling of high-resolution satellite for selected sites, and Accounting of this indicator should be done in terms of carbon units referred as close as possible to extraction of biomass from the above ground carbon pool.*”.

### **c Validation of methodology against criteria**

The rate of illegal logging for the assessment Year 6, 1 January 2015 to 31 December 2016, is informed by the same custom designed database that is updated monthly, and subject to routine internal audits, much like the processes established for the legal forest management practices mentioned in earlier sections of this report. DNV GL has verified that reporting on illegal logging activities is done via the GFC’s 32 forest stations located countrywide, as well as by field monitoring and audit teams, through the execution of both routine and random monitoring exercises and investigation procedures. The infractions are recorded, verified and audited at several levels, both in the field and at the main database. All infractions are summarized in the illegal logging database and result in a total volume being reported as illegal logging for any defined time period /3//29//30//37/.

The verification team concluded that the analysis methodology used by the GFC meets the requirements of JCN /57/ and if applied correctly, it will lead to assertions with minimum material discrepancies.

#### **5.6.2 Verification of Indicator**

In order to verify the reported assertions of Indicator 2.5 in Year 6, the verification team performed the following checks:

- Consolidation, calculation and reporting: Confirmation that the total reported in the database is consistent with the figure reported in the IMR;
- Recording: Database records were randomly chosen and data was compared with the hard copy documents;
- Collection: Hard copy records from the forest/transport stations were not available with regards to illegal logging as too much time had transpired since record collection, yet random original records were checked with the database records and no discrepancies were found. Willems Timber Field Forestry Concession records of all volume removed, including illegal logging activity, have been produced, stored, and verified for the concession to date.

The estimated emissions from illegal logging for Year 6 are equal to 9 140 tCO<sub>2</sub>. The DNV GL team also verified that the calculations for arriving at this amount also took into consideration long term wood product storage, as well as collateral damage emission factors (as was done with the forest management indicator).

### **5.7 Verification of Interim indicator 2.6 - Emissions resulting from anthropogenically caused forest fires**

#### **5.7.1 Methodology validation**

High-resolution Sentinel-2 data is being used to find and determine the extent of the burnt areas. MODIS Fire Hotspot data (FIRMS) are being used by the GFC to assist in finding the location of anthropogenic fires and for the decision on whether the deforestation driver was fire or not. The detection of burnt areas has been integrated into the mapping procedures for deforestation and degradation, where fire is one of the possible drivers for a deforestation or degradation event. The combined use of high-resolution multispectral images with FIRMS fire hotspot data is in accordance with the GOFC GOLD Sourcebook /58/.

## 5.7.2 Verification of Indicator

The audit team has verified the correct operation of the GIS mapping team regarding mapping the extent of deforestation and degradation and their drivers, including fire, and found their mapping to be concise and consistent with their mapping SOP /15/.

According to the reported assertions, the total burned area (degradation, not deforestation) in the analysis period was 762 ha/year. While there was a steady increase in Years 2, 3, 4 and a decline in Year 5 (28 ha/year, 208 ha/year, 395 ha /year and 265 ha/year, respectively), this years' area degraded by fire is considerably higher than all other monitoring years. Note that this indicator and Indicator 2.4 might overlap with each other, as usually fire is used as a field preparation measure for areas under shifting cultivation.

The verification team confirmed that the figure of 762 ha/year is consistent with the verification result.

## 5.8 Verification of Interim indicator 2.7 – Encouragement of increasing carbon sink capacity of non-forest and forest land

In line with the JCN /57/ this indicator is presently not monitored till the full MRV is in place. GFC has however started to develop a methodology for measuring and reporting of this indicator. Areas which show recovery of forest stock at previously deforested areas are mapped for future assessments. Although the areas are not considered in the overall assessment, the areas are distinctly labelled which will allow tracking and the specific changes overtime within the GIS system from Year 5 onwards. All areas larger than 0.25 ha are being mapped and tracked. However, for Year 6 GFC has not been reporting on this, as there was focus on the switch to Sentinel-2 and the degradation estimates by sample instead of wall-to-wall mapping.

In addition, The DNV-GL team has visited some mining sites which were abandoned between 5 and 10 years ago, and though some vegetation regeneration was evident, this was negligible in terms of biomass.

The main validation criteria would be the GOFC-GOLD REDD Sourcebook /58/ as the JCN /57/ guidance document does not provide any guidance. The JCN only states that this indicator is not relevant for the interim period before a proper MRVS is in place.

In line with the overall adoption of the GFC mapping methodology agreed upon in the JCN, reforestation is manually mapped using high-resolution imagery. The verification team has checked the reforestation areas and reporting in their GIS systems, and has found the mapping of the areas of recovery (reforestation) to be consistent with the mapping SOP/15/.

The verification team concludes that the analysis methodology used by the GFC meets provisions of the GOFC-GOLD REDD Sourcebook /58/.

### 5.8.1 Verification of Indicator

Though GFC did not report on this in Year 6, there is an ongoing attempt to include areas of shifting cultivation in the wall-to-wall mapping to enable future reporting.

Since this Indicator is not yet formally part of the indicators to be verified and the GFC did not report on this in Year 6, the team did not do any verification of figures. A verification in the field indicated that there is no significant biomass regrowth happening on old abandoned mining sites

## 6 STAKEHOLDER ENGAGEMENT

### 6.1 STAKEHOLDER COLLABORATION

#### 6.1.1 Community Monitoring Reporting & Verification (CMRV)

During Year 6 activities, GFC staff have continued to implement measures so as to socialize their processes and illustrate the importance and benefit of their work to constituents so as to be seen as an enabling and friendly institution, rather than a strict enforcement and penalizing one. One of main activities in this respect continues to be the building of capacities within local Guyanese communities to conduct Community Monitoring Reporting & Verification activities (CMRV). Over the last couple of years, a focus has been placed on including local communities in the lifting and validating of field data to ensure that this was done in compliance with the GFC's Standard Operating Procedures. In this regard, the GFC has been working with partners, mainly WWF, to advance further work and progress on CMRV. Among the main areas of progress in the Year 6 period that have been advanced in conjunction with WWF are:

- *The North Rupununi District Development Board's (NRDDB) 19 communities on 10 titled parcels (234,006 hectares of forest) have received training and facilitation to produce resource-use maps, village histories, village development and spatial plans sufficient to make them eligible to opt-in to a payment mechanism for forest carbon. They have also received training in FPIC, bookkeeping, conflict resolution and governance.*
- *38 monitors, two from each of the 19 communities have completed their CMRV training and have gathered and compiled the data for their village's (updated) baseline.*
- *A CMRV resource centre has been outfitted at Bina Hill to provide technical back up to the monitors and assistance in analysis and mapmaking*
- *Provided training and facilitation in opt-in readiness planning and capacity development for the Opt-in Pilot community of Muritaro.*

Despite all this progress, it is clear that none of the work invested in capacity building and in training has been able to produce an operational link with the national MRVS system, nor has there been any progress made with regards to the piloting of an Opt-In mechanism that was to be spearheaded by the Office of Climate Change and which, according to the JCN, should have commenced in 2015. However, the verification team realizes that the GFC and its corresponding ministry have undergone restructuring where by some of the ministries responsibilities may have moved to other institutions, or where progress on the opt-in mechanism pilot has halted due to circumstances beyond the GFC's control. Hence CAR 5 has been raised in order to obtain further information as to how and if the GFC will support the new government body with the implementation of these specific JCN requirements regarding CMRV and the Opt-In Mechanism. In any case, it is clear that local communities and other stakeholders may continue to lose interest in joint-monitoring systems and other programs, or even REDD+ in general, if further progress is not made with regards to these requirements /48//49//51//52/.

## 7 COMMENTS BY STAKEHOLDERS TO REPORT

The Interim Measures Report was published for public comments from 22 December 2017 to 22 January 2018 in Guyana Forestry Commission's web page as well as distributed to a list of 38 individual stakeholders of 27 different stakeholder organisations. A Public Notice was placed in the local media over the 4-week period. Comments received during this period are given in the text

box below. Response from the GFC to these comments and the verification team's assessment are also included.

**Table 1: List of stakeholders consulted by the Guyana Forestry Commission**

	<b>Name</b>	<b>Agency Role</b>		<b>Name</b>	<b>Agency Role</b>
1	Maarten van der Eynden	Personal Capacity	20	Donald Singh	Guyana Geology and Mines Commission
2	Hege Ragnhildstveit	Government of Norway	21	Karen Small	Environmental Protection Agency
3	Edwin Aalders	DNV GL	22	Naseem Nasir	Guyana Lands and Surveys Commission
4	Carly Green	GFOI MGD	23	Deonarine Ramsaroop	Forest Products Association
5	Christophe Sannier	SIRS	24	Gregory Hodge	University of Guyana
6	Evan Notman / Sylvia Wilson	USAID/Silvacarbon/GFOI	25	Joel Fredericks	National Toshias Council
7	Erik Naasset	UMB	26	Kandila Ramotar	Office of Climate Change
8	Frank-Martin Seifert	ESA	27	Shereeda Yussuf	Office of Climate Change
9	Henrik Fliflet	NORWEGIAN GOVERNMENT	28	Janelle Christian	Office of Climate Change
10	Inge Jonckheere / Erik Lindquist	FAO	29	Raquel Thomas-Caesar	Iwokrama
11	Kay Kallweit	GiZ	30	Dane Gobin	Iwokrama
12	Maria Sanz Sanchez	GFOI MGD	31	Chuck Hutchinson	WWF Guyana
13	Martin Herold	GFOI R&D/WUR	32	Michael Williams	North Rupununi District Development Board
14	Pontus Olofsson	Boston university	33	Ivor Marslow	North Rupununi District Development Board
15	Ronald McRoberts	USFS	34	Bryan Allicock	North Rupununi District Development Board
16	Sarah Carter	GFOI R&D / GOFC-GOLD	35	Peter Persaud	TAAMOG (The Amerindian Action Movement of Guyana)
17	Stephen Stehman	SUNY	36	Ashton Simon	National Amerindian Development Foundation
18	Tom Harvey	GFOI	37	Mary Valenzuela	Guyanese Organisation of

	Name	Agency Role		Name	Agency Role
					Indigenous Peoples
19	Colin Sparman	Guyana Gold and Diamond Miners Association	38	Veetal Rajkoomar	Ministry of Natural Resources

## 7.1 Received comments and response by the Guyana Forestry Commission

**Comment by:** Government of Norway  
 NGO     Party     Other Stakeholders

**Subject:** Comments on MRVS Year 6 Report Ver. 1

**Comment 1:**

*Thank you for submitting an interesting MRVS report. I note that several technical developments have taken place since the last report, and I commend Guyana for all the hard work and effort that have gone into the development of the MRVS in general and this report specifically.*

**Response GFC:**

*The GFC has attempted to embrace the broader thrust of the MRVS Phase 2 in looking for new and emerging technical solutions to related MRVS areas, as well as to embrace the requirements of implementing a non-REDD+ payment option for the MRVS. This process has started in MRVS Year 6 and we thank you for keeping track on how these aspects are evolving.*

*Text inserted in Preface.*

**DNV GL:**

*The verification team assessed the comment and the response to be satisfactory.*

**Comment by:** Conservation International Guyana  
 NGO     Party     Other Stakeholders

**Subject:** Comments on MRVS Year 6 Report Ver. 1

**Comment 2:**

*This review is intended to provide a technical assessment of the Year 6 MRVS Interim Report. Guyana's MRVS is a national system with great potential to set the learning curve and standard for the development of similar systems globally. The Guyana Forestry Commission (GFC) and partners should be commended once again for their dedication towards conducting the Forest Area and Carbon Assessments and reporting at such a high technical calibre. Specifically, it is important to acknowledge the credible move toward newer satellite constellations with the aim of improving overall efficiency of the report. At the same time, this allows reporting to evolve from interim reporting to a fully-fledged forest monitoring system that responds to the interests of the various sectors, especially as Guyana moves towards green economic development.*

**Response GFC:**

Moving towards new developments in the field of MRVS is a critical area for the GFC in ensuring that the most technically sound but yet cost effective options are utilised in the national monitoring.

Year 6 has embraced this in large part. There are plans in place to move beyond reporting on the interim indicators in Year 7.

**DNV GL:**

The verification team assessed the comment and the response to be satisfactory.

**Comment by:** Conservation International, Guyana

NGO  Party  Other Stakeholders

**Subject:** Comments on MRVS Year 6 Report Ver. 1

**Comment 3:**

The integration of the MRVS at decision making at land use and policy levels should be enhanced. This current situation may be mostly because the system is well advanced from the current spatial technologies and capacity available across other natural resource agencies and the disintegrated way forests are managed. It would be of use to elaborate any plans to rectify this.

**Response GFC:**

The results of the MRVS have allowed for the product of the MRVS work to be used for several applications currently, including: the modelling effort under Guyana's Green State Development Strategy and related analytical applications; identifying potential sites for hydro power; regional planning at municipal level; and planning of mineral allocation sites, to name a few areas.

It is intended that this will continue in other areas of work. One of the main enablers for this will be making the results of the MRVS work publicly accessible through the information platform. This is currently in development.

It is intended that through the ongoing efforts by the Guyana Lands and Surveys Commission in developing a National Land Policy for Guyana, that the MRVS data and results will be used to inform national planning across land uses.

**DNV GL:**

The verification team assessed the comments as part of its assessment of the methodology applied by GFC and its interview with stakeholder /48/. Based on general finding the team issued a CAR (CAR 4)

**Comment by:** Conservation International, Guyana

NGO  Party  Other Stakeholders

**Subject:** Comments on MRVS Year 6 Report Ver. 1

**Comment 4:**

There should be mention of CMRV related work in the Report; it would be of use to include some thinking around this especially as it relates to the integration of efforts in the North Rupununi and Kanashen into the national system.

**Response GFC:**

The GFC has been working with partners including WWF, to advance work on CMRV. These will likely link to a potential new bilateral agreement and the Opt In Mechanism currently being developed by the Office of Climate Change. Among the main areas of progress in the year 6 that have been advanced by WWF are:

- The North Rupununi District Development Board's (NRDDB) 19 communities on 10 titled parcels (234,006 hectares of forest) have received training and facilitation to produce resource-use maps, village histories, village development and spatial plans sufficient to make them eligible to opt-in to a payment mechanism for forest carbon. They have also received training in FPIC, bookkeeping, conflict resolution and governance.
- 38 monitors, two from each of the 19 communities have completed their CMRV training and have gathered and compiled the data for their village's (updated) baseline.
- A CMRV resource centre has been outfitted at Bina Hill to provide technical back up to the monitors and assistance in analysis and mapmaking
- Provided training and facilitation in opt-in readiness planning and capacity development for the Opt-in Pilot community of Muritaro.
- Beginning in February 2018, monitors will be trained from 16 KMCRG communities and Muritaro in CMRV.

It is intended that these efforts, as well as support from the national MRVS, will help to advance the readiness of potential new area into the national system.

Insert made in Section 1.4 of Version 2 of MRVS Year 6 Report.

**DNV GL:**

The verification team assessed during interview with stakeholder /47//48//53/and the GFC staff the CMRV and following its findings issued a CAR (CAR 5)

**Comment by:** Conservation International, Guyana

NGO     Party     Other Stakeholders

**Subject:** Comments on MRVS Year 6 Report Ver. 1

**Comment 5:**

The report is quite technical in certain sections and opens the view of how well persons without the required technical orientation can effectively contribute during the 1- month public review process for this draft. The extended holiday period also takes away from the attention the report can receive from the public. Given the MRVS report is a performance- based mechanism, many of the areas beyond the technical work demonstrated in the report, require targeted responses and responsible agencies to carry on such work.

**Response GFC:**

The GFC has also released a Summarised, more user-friendly version of the Report as well. In some parts of the Report, it is necessary to explain in full technical detail. The public review period ended on 22nd January, and allowed a full month, and three weeks post-Christmas, for review and feedback.

*It is intended that the product of the MRVS programme will be taken up for more national policy initiatives such as the development of the National Land Policy, currently in development and led by the Guyana Lands and Surveys Commission.*

*The GFC continues to be accessible (even beyond the comment period) to any stakeholder who may have any question or clarification or would request a demonstration on how MRVS results can fit new/existing demands.*

**DNV GL:**

*The verification team assessed during interview with stakeholder /47/ the comment and has issued an observation (Obs 1) for improvement.*

**Comment by:** TAAMOG

NGO     Party     Other Stakeholders

**Subject:** Comments on MRVS Year 6 Report Ver. 1

**Comment 6:**

*It is encouraging to see that even though there was a time lag in commencing with this new phase given the time taken to finalize the project agreement between Norway and Guyana, that a continuous assessment was still enabled.*

**Response GFC:**

*The GFC is keen to keep the momentum up even with the later start for the year 6 which began in September 2017. For this reason, there was a concerted effort to complete the year 6 assessment in 2017 and to bring the MRVS up to current date by conducting a 24 month reporting period as the Year 6.*

*It is hoped that for year 7, this will be on track as previous years, and perhaps even earlier.*

**DNV GL:**

*The verification team assessed the comment and the response to be satisfactory.*

**Comment by:** TAAMOG

NGO     Party     Other Stakeholders

**Subject:** Comments on MRVS Year 6 Report Ver. 1

**Comment 7:**

*TAAMOG is of the opinion that the process of allowing public comments is commendable and speaks of transparency and good practice by the GFC.*

**Response GFC:**

*The process has benefited greatly from the public review and feedback process. Several areas are revised via this process and this lend to a stronger Version 2 of the Report.*

*We hope to continue this part of the verification process for the future years of Phase 2.*

**DNV GL:**

*The verification team assessed the comment and the response to be satisfactory.*



**Comment by:** TAAMOG

NGO  Party  Other Stakeholders

**Subject:** Comments on MRVS Year 6 Report Ver. 1

**Comment 8:**

*TAAMOG has noted that the deforestation rate has decreased significant from previous years and would like to commend the work of the GFC in leading this drive to maintain forest cover at high levels. The low deforestation rate is testimony to the strong and effective Stewardship of the forest by the Guyana Forestry Commission. The GFC programme under the EU FLEGT VPA will also fit in nicely with this good forest governance and monitoring by the GFC.*

**Response GFC:**

*The main driver of deforestation for year 6, as was also the case of previous years, was mining. This saw a notable decline in Year 6 and points to several developments that have taken place at the policy level in enhancing monitoring at the mining sector level.*

*These are elaborated in the Section on National Trends of the Report.*

*The GFC is pleased to be part of this effort and outcome and to continue its role in the sustainable management of the State Forest.*

**DNV GL:**

*The verification team assessed the comment and the response to be satisfactory.*

**Comment by:** TAAMOG

NGO  Party  Other Stakeholders

**Subject:** Comments on MRVS Year 6 Report Ver. 1

**Comment 9:**

*The move to a no-cost option for data for satellite cover for deforestation monitoring (moving away from rapid eye and using the freely available high resolution cover from sentinel) is a good advancement that will reduce the pressure on financial resources for routine and continuous monitoring in the future, especially in a situation when there is no dedicated project financing.*

**Response GFC:**

*The GFC has attempted to embrace the broader thrust of the MRVS Phase 2 in looking for new and emerging technical solutions to related MRVS areas, as well as to embrace the requirements of implementing a non-REDD+ payment option for the MRVS. This process has started in MRVS Year 6 and we thank you for keeping track on how these aspects are evolving.*

*Text inserted in Preface.*

**DNV GL:**

*The verification team assessed the comment and the response to be satisfactory.*

**Comment by:** TAAMOG

NGO  Party  Other Stakeholders

**Subject:** Comments on MRVS Year 6 Report Ver. 1

**Comment 10:**

*The change in the approach for degradation monitoring is also viewed by TAAMOG as a very positive move. Generating a national map may not be necessary or required to give a reliable account of forest degradation and the sample based approach done by the aerial surveys complemented by planet labs data is viewed as a good alternative approach that was piloted in year 6.*

**Response GFC:**

*Generating national maps and creating a historic and continuing time series, have been fundamental to a technically sound process. At this time, it is difficult to envision moving totally away from using a national map for deforestation mapping. A national map has the distinct advantage of creating and maintaining a national level data set that can serve as a useful time series for a range of applications – one most notable example is Guyana’s submission of its Position on Reference Level for REDD+ to the UNFCCC where Guyana was one of the first 6 countries in the world to make it submission. Guyana’s submission received very positive feedback from the UNFCCC’s technical assessment process. This entire undertaking was supported by the availability of the national data set and time series enabled by the national map created for every assessment period, including the historic period.*

*However, there is growing momentum at the international level that sample based approach can be considered as a good option for monitoring some aspects of forest change.*

*Using the accuracy assessment as the source data set for the degradation monitoring for year 6, is a reflection of the GFC exploring this option. This was seen as a good avenue since the AA is based on a national sample, and executed through a fairly advanced and mature process with high quality and resolution data.*

**DNV GL:**

*The verification team assessed during interview with stakeholder /53/ the comment and in addition to its own findings during the audit a two CARs (CAR 2 and CAR 3) have been issued.*

**Comment by:** TAAMOG

NGO     Party     Other Stakeholders

**Subject:** Comments on MRVS Year 6 Report Ver. 1

**Comment 11:**

*The integration of the pioneering work of the Global advocate of earth observation monitoring- google earth engine, within Guyana’s MRVS system brings Guyana’s in line with new and modern approach and technologies for MRVS work. This is seen as a good addition to the year 6 work. For year 7, TAAMOG’s expectation is for there to be a smooth continuation of the routine reporting and for there to be further advancement of the sample based system of degradation monitoring, as well as for movement towards freely available imagery for deforestation monitoring.*

**Response GFC:**

*We also agree that the integration of GEE in the GFC’s national MRVS was a good addition. This has helped to build efficiencies in a number of key areas of the MRVS.*

*It is hoped that this can further be advanced in the upcoming years, as will further exploring of the sample based approach to degradation monitoring (though continuing with the national map for deforestation), as well as expanding the use of freely available high resolution imagery – whilst still maintaining a high accuracy on mapping results.*

**DNV GL:**

*The verification team assessed during interview with stakeholder /53/ the comment and in addition to its own findings during the audit, two CARs (CAR 2 and CAR 3) have been issued.*

**Comment by:** TAAMOG

NGO     Party     Other Stakeholders

**Subject:** Comments on MRVS Year 6 Report Ver. 1

**Comment 12:**

*TAAMOG hopes that there will be future financial incentives tied to this reporting and thus urge all parties to re-negotiate a new Norway agreement. Finally, congratulations to Norway for the continued interest shown in the forest sector of Guyana*

**Response GFC:**

*We also share this hope for a new agreement. Norway has continued to be a committed partner to our work on the MRVS.*

**DNV GL:**

*The verification team assessed during interview with stakeholder /53/ the comment and in addition to its own findings during the audit a CAR (CAR 5) has been issued.*

**Comment by:** Norwegian Government

NGO     Party     Other Stakeholders

**Subject:** Comments on MRVS Year 6 Report Ver. 1

**Comment 13:**

*Thank you very much for an interesting report and for making sure that it is open for public comments. The Norwegian government is pleased to see that a lot of hard work has gone into making this report and note that there been several technical developments since the last report.*

**Response GFC:**

*The process has benefited greatly from the public review and feedback process. Several areas are revised via this process and this lends to a stronger Version 2 of the Report.*

*We hope to continue this part of the verification process for the future years of Phase 2. The GFC has attempted to embrace the broader thrust of the MRVS Phase 2 in looking for new and emerging technical solutions to related MRVS areas, as well as to embrace the requirements of implementing a non-REDD+ payment option for the MRVS. This process has started in MRVS Year 6 and we thank you for keeping track on how these aspects are evolving.*

**DNV GL:**

*The verification team assessed the comment and the response to be satisfactory.*

**Comment by:** Martin Herold

NGO  Party  Other Stakeholders

**Subject:** Comments on MRVS Year 6 Report Ver. 1

**Comment 14:**

*6 IPCC land use classes: does the GFC have capacities to monitor all area changes activity data?*

**Response GFC:**

*Yes, we currently monitor the transition of land use and cover over time. At this point the focus has been on forest to non-forest and degradation activities as set out in the Interim reporting measures.*

**DNV GL:**

*The verification team assessed during interview with stakeholder /50/ the comment and considers the response to be satisfactory.*

**Comment by:** Norwegian Government & Maarten van der Eynden

NGO  Party  Other Stakeholders

**Subject:** Comments on MRVS Year 6 Report Ver. 1

**Comment 15:**

*RapidEye imagery has not been used for the Year 6 assessment.*

- Could you elaborate on why not?*
- Did you perform an assessment of the consequences of moving to Sentinel II as the main data basis?*
- Is there e.g. a risk that less deforestation is picked up by the system as a consequence of the 10m resolution vs. the more detailed resolution of RapidEye imagery?*

**Response GFC:**

*The formalising the MRV phase II agreement which concluded in September 2017, between GoG/Norway/CI meant that no commercial arrangement with RapidEye was established back in 2016 for the 2015-2016 period. This meant that alternative imagery (Landsat and Sentinel) were evaluated and used to track deforestation events.*

*The Sentinel and Landsat imagery were assessed to ensure that they overlaid the existing change base maps. Any change events detected with the Landsat 30 m imagery were compared against Sentinel 2 images to confirm the deforestation boundaries. For deforestation the minimum mapping unit is 1 ha so both datasets are appropriate to detect changes of this size.*

*The spatial resolution of Sentinel is sufficient, in its native format RapidEye pixels are 6.5 m resolution and resampled to 5 m. The increased revisit of the Sentinel satellite (every 5 days) also assists to ensure that change areas are correctly detected, and boundaries defined. Further, the definition of forest has remained the same, the SoP for mapping has remained the same as previous years, and the Accuracy Assessment was also conducted using an independent data set to the Sentinel data set.*

Yes, the assessment of the movement from Rapid Eye to Sentinel was captured through the independent results of the Accuracy Assessment. An analysis of the findings of the Accuracy Assessment is presented in Section 4 of the Report and has confirmed that the accuracy of the mapped product from a Rapid Eye data source to a Sentinel coverage map has remained high in the year 6 period. Interestingly, the national map concluded on a higher rate of deforestation (for the first time) than the Accuracy Assessment which emphasizes the point that there is low proven tendency for less deforestation being picked up with the Sentinel data set.

Text and map inserted in Section 4.

The intention moving into the next assessment period is to continue the use of both Sentinel and Landsat. A prototype system has been developed that uses these data in real time to improve the detection and classification of change events. This system will be used in tandem with the current forest monitoring system.

**DNV GL:**

The verification team assessed during interview with stakeholder /49/ the comment and based on its findings of the audit two CARs were issued (CAR 2 & CAR 3).

**Comment by:** Martin Herold

NGO  Party  Other Stakeholders

**Subject:** Comments on MRVS Year 6 Report Ver. 1

**Comment 16:**

*It has been noted that Guyana has begun to consider the "non-REDD+ payment" option through:*

- *Multiple data sources being used: L7/8, Rapideye, S2 (Landsat-based all along) – but use accuracy data to confirm consistency for reporting*
- *Commencing exploring the opportunity to refine the methodology for the purpose of increasing efficiency (move away from commercial options (Guyana moved to using Sentinel), role for audit and independent verification (Guyana has moved to Accuracy Assessment being used as sample based approach for degradation assessment), cloud computing (Guyana has moved to using GEE))*

**Response GFC:**

*All good points. The MRVS has continued to evolve and look at viable opportunities to become increasingly cost efficient. The availability of high quality free imagery has assisted in enabling this. This is further advanced through access to cloud processing platforms. Auditors add to the process by offering an impartial assessment of the validity of the results and importantly providing transparency as required by stakeholders.*

**DNV GL:**

The verification team assessed during interview with stakeholder /50/ the comment and based on its findings of the audit three CARs were issued (CAR 2 & CAR 3 & CAR 4) as well as one Observation (OBS 1).

**Comment by:** Martin Herold

NGO  Party  Other Stakeholders

**Subject:** Comments on MRVS Year 6 Report Ver. 1

**Comment 17:**

*It is good to see the integration of S2: what are the lessons learned? Access to cloud computing (SEPAL?)*

**Response GFC:**

*Sentinel data has proven to provide a robust dataset for monitoring change. The large image footprint and revisit period means that it is possible to efficiently monitor large areas. Cloud-based and pixel-level processes increase the utility of GFC's resource monitoring system.*

*GFC has reviewed the SEPAL system and has a good working relationship with the Forestry team at FAO. A technical training mission with the SEPAL team is planned for mid-2018.*

**DNV GL:**

*The verification team assessed the comment and the response to be satisfactory.*

**Comment by:** Martin Herold

NGO  Party  Other Stakeholders

**Subject:** Comments on MRVS Year 6 Report Ver. 1

**Comment 18:**

*Not clear whether "annual" mosaics (of L8, S2 etc.) are used or the full-time series*

- *Increasing recognition of "temporal precision"*

**Response GFC:**

*It is a compilation of both: images are downloaded annually for the assessment year, however we have images to be used as reference data that goes as far back as 1990. Individual Landsat and Sentinel scenes are used for the analysis. In this way the timing of each change event is more accurately recorded.*

**DNV GL:**

*The verification team assessed during interview with stakeholder /50/ the comment and considers the response to be satisfactory.*

**Comment by:** Norwegian Government

NGO  Party  Other Stakeholders

**Subject:** Comments on MRVS Year 6 Report Ver. 1

**Comment 19:**

*On the proposed activity 1.2.1 the proposal says that work will be undertaken to Assess current stratification for shifting cultivation and mining degradation and revise as needed to improve emission estimation. According to the MRVS Y6 report, this work will be undertaken in 2018.*

**Response GFC:**

*This work has begun in 2017 and will be continued in 2018. A stratification update report has been prepared, exploring the potential need for revised stratification based on changes in potential for*

change and the road network that have occurred since original stratification was conducted. Additionally, for the first time a definition of degradation has been developed, to be used going forward. For shifting cultivation, the need for revised stratification is largely associated with the definition of degradation, and whether it includes shifting cultivation. For mining degradation, a simplified accounting method is currently being developed, which will help to address need for revised stratification.

Added information presented in Section 1.4 of the full Report.

**DNV GL:**

The verification team assessed the comment and the response to be satisfactory.

**Comment by:** Norwegian Government

NGO  Party  Other Stakeholders

**Subject:** Comments on MRVS Year 6 Report Ver. 1

**Comment 20:**

On the proposed activity 1.2.3 to improve emissions factors for some specific processes (towards tier 3) the report gives little information. We understand it as being work in progress and look forward to more reporting on this for 2017 and 2018.

**Response GFC:**

This will be undertaken in 2018, and will follow from the simplified mining degradation method and the revised stratification (if needed). We are currently analysing existing destructive sampling data to assess whether it would be more appropriate to use different allometric equations than have been used previously (to increase accuracy and reduce uncertainty). The results of this analysis may impact the emission factors as well.

Added information presented in Section 1.4 of the full Report.

**DNV GL:**

The verification team assessed the comment also as part of the CAR 4 from 2014 and decided that based on the findings would keep the CAR open till next audit.

**Comment by:** Norwegian Government

NGO  Party  Other Stakeholders

**Subject:** Comments on MRVS Year 6 Report Ver. 1

**Comment 21:**

When it comes to activity 1.2.4 on Update on forest biomass and carbon stocks data, the report is not clear on when we can expect to get more information. We would appreciate if the report gives information based on available data and/ or indicates in which year this work will commence.

**Response GFC:**

In year 6, based on the analyses of the need for re-stratification and the potential to use revised allometric equations, along with the final simplified mining degradation methodology, the need for new field data is being re-evaluated. This work has started in 2016-2017 with the collation of the

year 6 activity data, assessment of the completeness and compatibility of year 6 with historical layers, and updated information collated on new roads. This work will be further advanced in 2018.

Added information presented in Section 1.4 of the full Report.

**DNV GL:**

The verification team assessed during its assessment and based on its findings raised an observation (OBS 2) and kept open the 2014 CAR 4

**Comment by:** Martin Herold

NGO  Party  Other Stakeholders

**Subject:** Comments on MRVS Year 6 Report Ver. 1

**Comment 22:**

Table 2.1: should/could be presented as change matrix (approach 2 or 3) rather than as net changes (approach 1)

**Response GFC:**

Updated to avoid confusion, removed the Year 5 table, to only include the Year 6 summary as this is the overview section for Year 6. It is possible that non-forest to (other) non-forest changes exist, but this not tracked by GFC, such updates come from other sources/commissions as the data is made available.

**DNV GL:**

The verification team assessed during interview with stakeholder /50/ the comment and considers the response to be satisfactory.

**Comment by:** Martin Herold

NGO  Party  Other Stakeholders

**Subject:** Comments on MRVS Year 6 Report Ver. 1

**Comment 23:**

Treatment of area estimate from mapping versus adjusted area (2015/16):

- p.32: 18416 ha
- p.49: 16239 ha (CI95: 12436-20041 ha)
- Tendency to report adjusted area estimate.
- Take a look also at previous years – does the trend change?

**Response GFC:**

P 32 value is the (mapped) deforestation value from the team at GFC using the Sentinel data.

A map has been included in Section 4 to show the comparative trend between the mapped and adjusted (AA) rates.

P 49 value and CI is derived from the accuracy assessment.



*This is an independent assessment, separate to the value generated by GFC. This is why there is a differences.*

**DNV GL:**

*The verification team assessed during interview with stakeholder /50/ the comment and considers the response to be satisfactory.*

**Comment by:** Norwegian Government, Martin Herold, Maarten van der Eynden

NGO     Party     Other Stakeholders

**Subject:** Comments on MRVS Year 6 Report Ver. 1

**Comment 24:**

*After a more general reading of the year 6 report, we would like to point out that it is a bit confusing when annualized rates and absolute rates for the Year 6 reporting are used in different parts of the document. We would suggest that you consider presenting the absolute rates and numbers early in the report, show clearly what the annualized rates are, and then use the annualized rates consistently after that. This could improve clarity.*

*Not sure whether all results tables provide annualized data (clarify)*

**Response GFC:**

*Thank you for the suggestion, adjustments made for improved clarity on the use of the 24 month and annualised rates throughout the Report.*

**DNV GL:**

*The verification team assessed during interview with stakeholder /49//50/ the comment and its own assessment and issued a CAR (CAR 1).*

**Comment by:** Norwegian Government, Martin Herold, Maarten van der Eynden

NGO     Party     Other Stakeholders

**Subject:** Comments on MRVS Year 6 Report Ver. 1

**Comment 25:**

*The report states that Guyana's deforestation rate in 2015- 16 is at 0,05 % per year. There is a marked decrease in deforestation from mining and agriculture compared to previous years, but an increase in terms of fire. For public communication purposes, the report could benefit from explaining the assumed reasons for the decline from various drivers of deforestation (see table 4- 3 at page 14 of the summary report) as well as the increase from others.*

**Response GFC:**

*Among the main factors that have continued to the decrease in deforestation from mining has been the shift towards more large scale mining - two main large scale operators are in full operation. A supporting reason is the move to EITI has led to several preparedness efforts at the mining sector to strengthen governance and management. There has been emphasis on looking at effective implementation of codes and guidelines and the field monitoring has also expanded. Other factors that also contributed are the decline in prices and the challenges in access experienced by miners. Deforestation has declined from 2012 (USD1,900/ounce) which marked a point where the gold*

price was the highest since 1980. Post 2012 the price has declined to around USD1300/ounce. This combined with limited accessibility has gradually reduced the area mined.

Explanation included for each Driver in Section on National Trends in the MRVS Report.

**DNV GL:**

The verification team assessed during interview with stakeholder /49//50/ the comment and considers the response to be satisfactory.

**Comment by:** Norwegian Government, Martin Herold, Maarten van der Eynden

NGO  Party  Other Stakeholders

**Subject:** Comments on MRVS Year 6 Report Ver. 1

**Comment 26:**

Please also comment Table 4-1 in Summary report: The annualized change rate for the period 1990-2009 seems to be for the entire period. Please present the annualized total.

**Response GFC:**

Thank you. Correction made, total now reflect annual results

**DNV GL:**

The verification team assessed the comment and the response to be satisfactory.

**Comment by:** Martin Herold

NGO  Party  Other Stakeholders

**Subject:** Comments on MRVS Year 6 Report Ver. 1

**Comment 27:**

Any idea on the change in degradation mapping?

**Response GFC:**

In the Year 6 assessment, Degradation values were calculated based on interpretation of the accuracy assessment samples. It has shown some fluctuation between the assessment periods, so it is not unexpected. For this assessment the value is based on the results of the accuracy assessment. A general description is provided as follows:

The original sample design is weighted so greater number of samples are interpreted in areas deemed to have a medium to high risk of change – as informed by the historical results of GFC's wall to wall mapping. The degradation value is calculated by reanalysis of the same sampling frame each time the assessment is repeated.

In previous assessments the degradation values between GFC and the accuracy assessment fall within the confidence limits of the sampling approach. This correspondence adds a degree of confidence that the degradation events are being captured.

It should be noted that GFC method only maps degradation that surrounds established infrastructure. The sample-based design has the advantage that it is representative of the entire land area of Guyana.

*In moving forward, critical to the degradation discussion is the new definition of forest degradation for Guyana. Based on the definition, we are currently re-evaluating which forms of degradation should be included, and better identifying what is significant, and what is de minimis. In particular, if shifting cultivation is defined as deforestation, it will no longer be mapped as degradation, aside from changes in rotation cycle.*

*Updated made to the Degradation Section of both full (Section 7.4) and summary reports (Section 4.4).*

**DNV GL:**

*The verification team assessed during interview with stakeholder /50/ the comment and based on its own assessment raised a CAR (CAR 3).*

**Comment by:** Martin Herold

NGO     Party     Other Stakeholders

**Subject:** Comments on MRVS Year 6 Report Ver. 1

**Comment 28:**

*Interesting to see and understand the pattern by driver:*

- *Some decline in mining related deforestation*
- *Agriculture is down overall (Tab. 7.4) but up in SFA*
- *Large increase in fire emissions (El Nino?)*
- *Harvesting reduced significantly*

**Response GFC:**

*Yes, mining has continued to develop where there is existing access and agriculture development continues to be conducted at a relatively small scale. The large fire events are tied to prolonged dry spell and more commonly observed on the drier sand and grassland areas. Forest harvesting in general has declined and is linked to some forest concessions ceasing operations.*

*More details have been added on each driver in Section on National Trends.*

**DNV GL:**

*The verification team assessed during interview with stakeholder /50/ the comment and considers the response to be satisfactory.*

**Comment by:** Norwegian Government

NGO     Party     Other Stakeholders

**Subject:** Comments on MRVS Year 6 Report Ver. 1

**Comment 29:**

*Point 6.5 in the summary report states that "In Year 6 and 7 the same benchmark IFL area was used. The analysis identified 290 ha of deforestation, 177 ha of which was mapped in Amerindian areas and 107 ha in State Lands. It is proposed that deforestation located in Amerindian areas is*

not counted in calculating the reduction in financial remuneration. These areas are part of the Government of Guyana's continuous land titling and demarcation programme."

Norway is an active supporter of the Government of Guyana's work on land titling for Amerindian peoples and land demarcation. However, we cannot see the reason for why deforestation that takes place inside Amerindian areas is not counted in calculating the reduction in financial remuneration. Deforestation inside Amerindian areas that qualify as IFL should, in our opinion, be calculated in line with other types of deforestation in Guyana.

**Response GFC:**

Thank you for the feedback. Indeed this area has been an evolving one and discussed throughout the years. The IFL definition provides for areas of "exclusion" that allows for utilisation areas, as well as settlements to be excluded for IFL monitoring. This deductions were initially done when the baseline for IFM was set back in 2010, for all relevant exclusions. Unfortunately this could not be done for all Amerindian Areas as these areas do not have GIS boundary points until they become titled (a continuous and ongoing process). The ideal situation of course, is if all Amerindian Area were to be established upfront, and for these to have been duly deducted from the IFL baseline all at once back in 2010. This was not possible for the reasons stated – being that the process is continuous and ongoing. The question would be whether one would prefer to stay true to the definition of IFL which requires you to make these exclusions or whether we would decide that exclusions would be a onetime circumstance for which deductions would only take place once. The GFC has continued to report on IFL by not altering the benchmark.

Any modification will have to be agreed jointly by Guyana and Norway before any change is made in the Report to the benchmark or reporting modalities.

**DNV GL:**

The verification team assessed the comment and the response to be satisfactory.

**Comment by:** Conservation International Guyana

NGO  Party  Other Stakeholders

**Subject:** Comments on MRVS Year 6 Report Ver. 1

**Comment 30:**

9.4 IFL -Efforts are needed to mainstream the MRVS to ensure actions that reduce changes to the IFL beyond the work of the GFC.

**Response GFC:**

This is agreed, it will be ideal if GIS boundaries of areas of titles/extension to Amerindian areas are known early so that provisions can be made within IFL. Additionally, managing areas of Intact Forest can then be a more collaborate approach with forest users as well as villages. GFC will continue to engage with the Protected Areas Commission to share information on IFL areas as these can serve as a baseline for monitoring at that level.

**DNV GL:**

The verification team assessed during interview with stakeholder /48/ the comment and considers the response to be satisfactory.

**Comment by:** Norwegian Government

NGO     Party     Other Stakeholders

**Subject:** Comments on MRVS Year 6 Report Ver. 1

**Comment 31:**

*We also take note that Planet data is used for the Year 6 accuracy assessment instead of imagery captured through overflights as in previous years. Is there a chance that the change in spatial resolution could systematically affect the results in some way? We would also like to know why imagery from 2015 was used. It would be our assumption that imagery from end of 2016 is most relevant if the total change for the whole period of 2015-2016 is to be measured?*

**Response GFC:**

*PlanetScope (note: Planet also provides RapidEye and SkySat) data are advertised at a spatial resolution of 3m, which seemed reasonable to be used for AA (Accuracy Assessment) as it is higher than RapidEye (5m resampled) and thus offers higher precision levels. On top of this, the PlanetScope solution is more cost-effective (both in time and funds) than the GeoVantage acquisition. Last but not least, the re-visit time of PlanetScope could potentially be used in the future for real-time monitoring of deforestation or forest degradation. Operationally, it is a risk to alter well-tried approaches, but thinking ahead, there is need to explore further and improve current processes. For example, the new OptiSAR constellation of UrTheCast looks promising regarding automatically detecting changes (SAR) and acquiring them (piggyback Optical sensor).*

*Regarding how the results may be affected in regards to spatial resolution: On paper, we expected little effect on assessing deforestation. We also knew it would make it more difficult to assess degradation. Following our work with PlanetScope, we discovered that the Doves, being small and so many, do not have the radiometric and geometric fidelity of their larger brethren. In other words, the radiometry and positioning varied among the imagery we received. Was it systematic? No. Did it influence the accuracy assessment? In occasions, we couldn't use the PlanetLabs image, and therefore used the Sentinel-2 image. In all cases, the GeoVantage 2015 was very useful (see answer on 2015 image usage).*

**DNV GL:**

*The verification team assessed based on its findings issued a CAR (CAR 3)*

**Comment by:** Maarten van der Eynden

NGO     Party     Other Stakeholders

**Subject:** Comments on MRVS Year 6 Report Ver. 1

**Comment 32:**

*I also note that Planet data is used for the Year 6 accuracy assessment instead of imagery captured through overflights as in previous years. As for the mapping, is there a chance that the change in spatial resolution could systematically affect the results in some way?*

**Comment 33:**

*Why was imagery also from 2015 used? Would not imagery from end 2016 be the most relevant if total change for the total period of 2015-2016 is to be measured?*

**Response GFC:**

The GeoVantage 2015 imagery was not used for assessing change for the two years. As you rightly point out, it shouldn't be used for decision making because we are assessing changes until end of 2016, not 2015. Instead, the high spatial resolution of GeoVantage 2015 provided an extra layer of information that assisted the interpreter in better understanding what the lower resolution image shows. For example, occasionally the 2016 imagery was of low resolution (e.g. use of Sentinel-2 in combination with a low radiometry PlanetScope image). The interpreter would use the 2015 high spatial resolution image to better understand what's happening on the ground, with the knowledge that this is the 2015 dataset and not 2016. Therefore, all decisions were based on what happened between 2014 and 2016, with assistance of a 2015 dataset when needed.

**DNV GL:**

The verification team assessed during interview with stakeholder /49/ the comment and considers the response to be satisfactory.

**Comment by:** Maarten van der Eynden

NGO  Party  Other Stakeholders

**Subject:** Comments on MRVS Year 6 Report Ver. 1

**Comment 34:**

The field of REDD+ MRV has been rapidly developing over the past years. Though initiatives such as the Global Forest Observation Initiative, methods and data for forest monitoring is being discussed by world leading experts in the field, and practical Methods and Guidance Documents are developed. One key development is that statistical estimation of forest area change is often recommended over more classical wall-to-wall approaches. Or even better; if these approaches can be combined, this is even better. Following this logic, one could even say that in many ways, the "accuracy assessment" currently being done could in the future be adapted to be the official estimate of deforestation, while the wall-to-wall map could be used to support the statistical estimation, and of course for a wide range of operational and policy development uses. In light of this, I would recommend, in line with earlier discussions, to invite some of the experts connected to the GFOI network to provide suggestions and recommendations for the Guyana MRVS. This would also contribute to disseminating the many impressive and interesting experiences generated by Guyana's MRVS work to the wider MRV community.

**Response GFC:**

Yes, that is a good point and the GFC team have contributed to (GFOI MGD) and learnt also from the evolving expert discussions. The Accuracy assessment process incorporates these ideas and has further expanded on the approaches to make them relevant to Guyana.

As additional countries have engaged in national monitoring it has become more apparent that there are several alternatives that provide forest change estimates and the merits of say wall-to-wall maps and sample-based approaches. The GFC welcome the continual interaction with GFOI and FAO and the opportunity to present and discuss the results and developments of Guyana's MRVS.

**DNV GL:**

The verification team assessed the comment and the response to be satisfactory.

**Comment by:** Maarten van der Eynden

NGO     Party     Other Stakeholders

**Subject:** Comments on MRVS Year 6 Report Ver. 1

**Comment 35:**

*I would encourage to explore which role the SEPAL system (formerly titled "SDMS") administered by the FAO can play in this.*

**Response GFC:**

*Thank you. We agree. Further exploring Sepal will be one of the areas advanced in 2018 and an exchange is planned for end of April 2018.*

**DNV GL:**

*The verification team assessed the comment and the response to be satisfactory.*

**Comment by:** Conservation International Guyana

NGO     Party     Other Stakeholders

**Subject:** Comments on MRVS Year 6 Report Ver. 1

**Comment 36:**

*Pg 3: The resolution of the data used meant it was not possible to conduct national scale monitoring of the impact of forest degradation.*

*- Some reference should be made here on the difference in definition of deforestation and forest degradation. Without this, there may be some confusion on what it means to not have this included in the report.*

**Response GFC:**

*Thank you. Text added to the Report (Section 2). The text clearly sets out the distinction with reference to Guyana's definition of forest as, "In the Standard Operating Procedures the definition of deforestation is summarised as the long-term conversion of land from forest use to other non-forest uses (GOF-C-GOLD, 2010). An important consideration is that a forested area  $\geq 1$  ha is only deemed deforested once the cover falls and remains below the elected crown cover threshold (30% for Guyana).*

*The main anthropogenic change drivers that lead to deforestation, identified in previous work and by the initial workshop at which the MRVS Road map was developed, include:*

- *Mining (ground excavation associated with small, medium and large-scale mining)*
- *Infrastructure such as roads (included are forestry landings and mining roads)*
  - *In year 4 (2013) a 'Settlements' driver was been added, to delineate areas where deforestation occurs due to human settlements. The area is immaterial, but it was a driver of change that could not adequately be covered by the existing schema.*
- *Agricultural conversion*
- *Fire (all considered anthropogenic and depending on intensity and frequency can lead to deforestation outside of a shifting cultivation landscape)*



There is debate internationally over the definition of forest degradation. A commonly adopted definition outlined in IPCC (2003) report is:

"A direct human-induced long-term loss (persisting for X years or more) of at least Y% of forest carbon stocks [and forest values] since time T and not qualifying as deforestation or an elected activity under Article 3.4 of the Kyoto Protocol ".

The main sources of forest degradation in Guyana are identified as:

- Selective and illegal harvesting of timber (not reported spatially in the MRVS)
- Shifting cultivation systems
- Fire
- 'Edge effect' degradation around mining sites and infrastructure (this is often not persistent and therefore it is questionable as to whether it is true forest degradation).

In 2017, Guyana has finalised a definition for Forest Degradation to reflect these national circumstances.

**DNV GL:**

The verification team assessed during interview with stakeholder /48/ the comment and considers the response to be satisfactory.

**Comment by:** Conservation International Guyana

NGO     Party     Other Stakeholders

**Subject:** Comments on MRVS Year 6 Report Ver. 1

**Comment 37:**

*Pg 5: Table 2-1/2-2: The breakdown of the table showing forest and non-forest is not clear. E.g. Settlements remain unchanged between both years (58,000 ha), however there seems to be a miscalculation of this figure, perhaps this was influenced by "rounding up".*

*- Possibly the information in section 3 could come before the table in section 2 since it adds meaning.*

*- Map 2-1: It is difficult to differentiate the legend features based on the symbology presently used.*

*- Map 3.1: Legend text is blurry.*

**Response GFC:**

*Updated to avoid confusion, removed the Year 5 table, to only include the Year 6 summary as this is the overview section for Year 6. It is possible that non-forest to (other) non-forest changes exist, but this not tracked by GFC, such updates come from other sources/commissions as the data is made available.*

*Map 2.1 updated and Map 3.1 enhanced.*

**DNV GL:**

The verification team assessed the comment and the response to be satisfactory.

**Comment by:** Conservation International Guyana

NGO     Party     Other Stakeholders

**Subject:** Comments on MRVS Year 6 Report Ver. 1

**Comment 38:**

*4.3 pg 11: Agency Responsibilities - It would be useful here to have the responsibilities of the agencies GGMC and GLSC, be assessed or included based on their role (current or potential) in the MRVS. It clarifies for the agencies themselves, how they are involved beyond the reporting periods.*

**Response GFC:**

*MRVS related areas added to the Section on Agency Responsibilities.*

**DNV GL:**

*The verification team assessed during interview with stakeholder /47//48/ the comment and issued an observation (Obs2).*

**Comment by:** Conservation International Guyana

NGO     Party     Other Stakeholders

**Subject:** Comments on MRVS Year 6 Report Ver. 1

**Comment 39:**

*4.5 pg 14- National trends - Several large fires have been identified. Are there any locations or possible ways these can be investigated further to ascertain their nature?*

**Response GFC:**

*Yes, the location and the boundaries are mapped for any fire event that result in forest change > 1 ha. Fire is quite easily separated from other forest change events.*

**DNV GL:**

*The verification team assessed during interview with stakeholder /48/ the comment and considers the response to be satisfactory.*

**Comment by:** Conservation International Guyana

NGO     Party     Other Stakeholders

**Subject:** Comments on MRVS Year 6 Report Ver. 1

**Comment 40:**

*5.3 MRVS Tasks and Development Areas- It would be informative to state whether capacity is being built within the mapping team to be able to actively undertake the research listed in table 5-2.*

**Response GFC:**

*Yes, it is intended that in the three areas that are associated with the new development aspects the GFC team will lead or be involved in the following ways:*

- Design of new SoPs – the GFC team will play an integral role in the design of new components and will conduct the analysis necessary for the new area. For areas of the new information platform, the model used by the Geospatial Information Management Unit under the Ministry of Natural Resources will be used for this purpose. This will allow for local inputs to be more readily accessible and available for the GFC’s team.

- Analysis and Field work – the GFC’s team will lead in the execution of field work for new development areas.

- Training – the GFC has used in the past a training of trainers approach whereby for new development areas, a core team is trained and these persons can then train new staff.

**DNV GL:**

The verification team assessed during interview with stakeholder /48/ the comment and considers the response to be satisfactory.

**Comment by:** Conservation International Guyana

NGO       Party       Other Stakeholders

**Subject:** Comments on MRVS Year 6 Report Ver. 1

**Comment 41:**

7.5 Transition of Degraded Areas to Deforestation- Therefore, it is expected that updates from degradation to deforestation, for legacy polygons will resume in Year 7.

- Will this be with the continued use of Sentinel?

**Response GFC:**

Yes, with the increased revisit frequency and spatial resolution any polygons identified as degraded will be updated if they change to a deforested state.

**DNV GL:**

The verification team assessed the comment and the response to be satisfactory.

**Comment by:** Conservation International Guyana

NGO       Party       Other Stakeholders

**Subject:** Comments on MRVS Year 6 Report Ver. 1

**Comment 42:**

Pg 38- A general observation of mining related change occurs centrally within the country, however Region 10 and 6 are emphasized to a smaller extent. Although change numbers in these regions can be quite low, are there ways to flag eminent land use changes that might be ecological or socially threatening? Especially as it relates to land allocation activities in forests.

**Response GFC:**

This point is important since one of the products of the MRVS is to track if new drivers emerge as well as if there is a growing shift in the trends of deforestation and forest degradation.

*It is intended that this information be used by the GGMC to analyse these emerging shifts and integrate action where necessary to provide for these emerging trends.*

**DNV GL:**

*The verification team assessed during interview with stakeholder /48/ the comment and considers the response to be satisfactory.*

**Comment by:** Conservation International Guyana

NGO     Party     Other Stakeholders

**Subject:** Comments on MRVS Year 6 Report Ver. 1

**Comment 43:**

*10 QA/QC Pg 63- Facilitating data sharing between agencies through inter-agency training.*

*- Given the structural changes in the agencies, how has this changed or improved?*

**Response GFC:**

*Whilst there have been several changes at the structural level, the GGMC and the GFC have remained under the Ministry of Natural Resources. The GFC continues to engage with the GLSC as this Commissioner remains a permanent part of the MRVS Steering Committee. Also, there continues to be a direct communication link between the GFC and these agencies. Facilitating data sharing and training remain well executed and managed.*

**DNV GL:**

*The verification team assessed during interview with stakeholder /47//48//53/ the comment and has issued an observation (Obs2).*

**Comment by:** Conservation International Guyana

NGO     Party     Other Stakeholders

**Subject:** Comments on MRVS Year 6 Report Ver. 1

**Comment 44:**

*Appendix 1- 5. Task 3.1.13 Explore options for development of an information platform for access to MRVS results and data.*

*- Department of Environment is currently in pursuit of developing a platform for the sharing environmental data across the country. Further research on this option is needed.*

**Response GFC:**

*Thank you for this suggestion. The GFC will liaise with the DOE for further information on this.*

**DNV GL:**

*The verification team assessed during interview with stakeholder /48/ the comment and considers the response to be satisfactory.*

## 8 REFERENCES

*Documents provided by the Project Participants have been used as direct sources of evidence for the periodic verification conclusions, and are usually further checked through interviews with key personnel.*

- /1/ Guyana Forestry Commission Guyana REDD+ Monitoring Reporting & Verification System (MRVS) Year 5 Interim Measures Report, Version 1 dated 7 October 2015, Version 2 dated 12 November 2015 and Version 3
- /2/ Guyana Forestry Commission: *Geodatabase with all raw and processed datasets*, February 2018.
- /3/ Guyana Forestry Commission: *Data Base of Illegal logging activities for the four forestry divisions of Bce, Dem, Ess and Nwd – 1 January 2015 to 31December 2016; 1 January 2015 to 31December 2016 – Year 6*
- /4/ Guyana Forestry Commission: *Data Base of Procedural Breaches for the four forestry divisions of Bce, Dem, Ess and Nwd – 1 January 2015 to 31December 2016; 1 January 2015 to 31December 2016 – Year 6*
- /5/ Guyana Forestry Commission: *Data Base of wood harvesting declarations of wood extraction activities in lands classified as State Forest– 1 January 2015 to 31December 2016; 1 January 2015 to 31December 2016 – Year 6*
- /6/ Guyana Forestry Commission: *Data Base of wood harvesting declarations of wood extraction activities in lands classified as Amerindian or Private Property– 1 January 2015 to 31December 2016; 1 January 2015 to 31December 2016 – Year 6*
- /7/ Winrock International: *Collateral Damage and Wood Products from Logging Practices in Guyana- December 2011*
- /8/ Guyana Forestry Commission: *Standard Operating Procedures for the Forest Carbon Monitoring system of Guyana – Revised August 2015*
- /9/ Guyana Forestry Commission: *Degradation around Mined Areas: Methods and Data Analyses for Estimating Emission Factor – November 2015*
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- /11/ *Assessment of Illegal Logging Indicator Year 6; Illegal Logging Production Table Year 6 2018; and Wood Products Storage in Guayana\_2015\_2016\_Illegal Logging. Xlsx.*
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- /16/ Sist, Plinio: 2000: *Reduced-impact logging in the tropics: objectives, principles and impacts.* International Forestry Review 2(1), 2000. Pages 3-10.
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2017

*Background documents related to the design and/or methodologies employed in the design or other reference documents.*

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- /19/ Guyana Forestry Commission: *Detention and Seizure Procedure*
- /20/ Guyana Forestry Commission: *Forest Monitoring Operating Procedure*
- /21/ Guyana Forestry Commission: *Procedure for Export of Forest Produce*
- /22/ Guyana Forestry Commission: *Procedure for Issuance of Sawmill Licence*
- /23/ Guyana Forestry Commission: *Procedure for issuing SFEP*, <http://www.forestry.gov.gy-Publications>
- /24/ Guyana Forestry Commission: *Procedure for issuing SFP*, <http://www.forestry.gov.gy-Publications>
- /25/ Guyana Forestry Commission: *Procedure for issuing TSA or WCL* , <http://www.forestry.gov.gy-publications.html>
- /26/ Guyana Forestry Commission: *Procedure for Timber Dealers Licence*
- /27/ Guyana Forestry Commission: *Forest inspector supervisory check list – Daily supervision of a forest station, midmonth and month end supervision, routine checks by forest rangers at forest stations, basic field verification*, January 2007
- /28/ Guyana Forestry Commission: *forest station internal audit control record*

*Persons interviewed during the initial verification, or persons who contributed with other information that are not included in the documents listed above.*

- /29/ Gavin Agard, Deputy Commissioner of Forests – GFC
- /30/ Pradeepa Bholanath, Head, PDD-GFC
- /31/ Monitoring Inspectors & Supervisors: Bartica and Iteballi Forest stations – GFC
- /32/ Nasheta Dewnath, Programme Officer – REDD Section
- /33/ Jeremy Singh, Project Officer, Management Trainee REDD Secretariat
- /34/ Chaplin Chan, Consultant – Indufor
- /35/ Chetram Ramgobind – Program Officer, Illegal Logging and Procedural Breach Database - GFC, Forest Resources Management Division – GFC
- /36/ Towana Smartt – GIS/Remote Sensing Officer, Forest Resources Information Unit – GFC
- /37/ Chandroutie Sookdeo – GIS/Remote Sensing Officer, Forest Resources Information Unit – GFC
- /38/ Dwayne Griffith, Project Officer, REDD Secretariat
- /39/ Hansrajie Sukhdeo, Project Officers – Data Management, REDD Secretariat
- /40/ Danny Donoghue, Durham University
- /41/ Pete Watt, Indufor
- /42/ Chaplin Chan, Indufor
- /43/ Nikolaos Galiatsatos, Royal School of Military Survey
- /44/ Jasmin Totaram, GIS/Remote Sensing Analyst
- /45/ Basantie Sukhu, GIS/Remote Sensing Analyst

- /46/ Bibi Nafeeza Amin, GIS/Remote Sensing Analyst
- /47/ Charles Hutchinson - REDD+ Coordinator for Guyana, WWF Guyana
- /48/ Kerry Anne Cort., Spatial Data Analyst at Conservation International Guyana
- /49/ Maarten van der Eynden – Personal capacity
- /50/ Martin Herold, GFOI R&D/WUR
- /51/ Donald Singh, Guyana Geology and Mines Commission
- /52/ Veetal Rajkumar, Ministry of Natural Resources
- /53/ Peter Persart, The Amerindian Action Movement of Guyana (TAAMOG)
- /54/ GFC Station staff in Iteballi Forestry/Transport Station
- /55/ Willems Timber Field Forestry Concession Staff Representative
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*Criteria of validation and verification*

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- /61/ IPCC (2000). *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*. Penman J., Kruger D., Galbally I., Hiraishi T., Nyenzi B., Emmanuel S., Buendia L., Hoppaus R., Martinsen T., Meijer J., Miwa K., Tanabe K. (Eds). Intergovernmental Panel on Climate Change (IPCC), IPCC/OECD/IEA/IGES, Hayama, Japan.
- /62/ IPCC (2003). *Good Practice Guidance for Land Use, Land-Use Change and Forestry*. Penman J., Gytarsky M., Hiraishi T., Krug, T., Kruger D., Pipatti R., Buendia L., Miwa K., Ngara T., Tanabe K., Wagner F. (Eds).Intergovernmental Panel on Climate Change (IPCC), IPCC/IGES, Hayama, Japan.
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- /72/ Det Norske Veritas: *Verification of Interim REDD+ Performance Indicators under the Guyana-Norway REDD+ Partnership, Monitoring Period: 01 January 2012 to 31 December 2012 – Year 3*, 24 February 2014
- /73/ DNV GL: *Verification of Interim REDD+ Performance Indicators under the Guyana-Norway REDD+ Partnership, Monitoring Period: 01 January 2013 to 31 December 2013 – Year 4*, 12 April 2015
- /74/ DNV GL: *Verification of Interim REDD+ Performance Indicators under the Guyana-Norway REDD+ Partnership, Monitoring Period: 01 January 2014 to 31 December 2014 – Year 5*, 22 February 2016

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## **APPENDIX A**

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### **CORRECTIVE ACTION REQUESTS, CLARIFICATION REQUESTS AND OBSERVATIONS**

## MINOR Corrective action requests and Observations of the 2014 audit

CAR ID	Major/Minor	Corrective action request	Response by Project Participants	DNV GL's assessment of response by Project Participants
<b>CAR 4</b>	<b>MINOR</b>	<p><b>Requirement:</b> Interim Measures 2.2 and 2.4</p> <p><b>Non-Compliance:</b> Biomass assessment plots of degraded forest within shifting cultivation areas are not adequately reflected within overall biomass calculation.</p> <p><b>Objective evidence:</b></p> <ul style="list-style-type: none"> <li>□ Fieldwork evidence shows that most, if not all, SA mapped as pioneer actually is rotational.</li> </ul> <p>Fieldwork evidence shows that the currently map identification of primary forest in shifting cultivation areas has led to the allocation of areas as primary forest where ground truthing of the same areas identified the area as rotational agriculture/degraded secondary forest.</p>	<p>The brief inspection conducted during the audit indicated that rotational shifting cultivation was classified as pioneer. It is worth noting that this the first year shifting cultivation has been reported. It is anticipated that as an approach 3 MRVS and with further repeat image coverages the attribution of both historical and new shifting cultivation areas will be improved.</p> <p>While the areas in question still fall within Guyana's definition of forest, it is recognised that this is secondary forest. It is expected that the historical extent of shifting cultivation areas will improve in line with annual coverages of high resolution imagery. The current work on Emission Factors by GFC will account for the differing carbon contents.</p> <p>It is planned for field assessments to be conducted to inform an emission factor for Shifting Agriculture. This will inform the impact that this activity has on biomass. This will remove the dependence of categorising shifting agriculture type using remote sensing methods only, which evidently has specific challenges.</p> <p>It is envisaged that an Emission Factor will be developed in 2015-2016 for Shifting Agriculture. It is likely that the emission factor will be a function of the forest-fallow cycle and local practices.</p> <p>The challenge will be how to count for the net emissions from this activity. It is still being assessed whether Shifting Cultivation mosaics are lengthening or shortening or stable. This determination will help to decide their role. Once an estimate of the average C stock is derived in different Shifting Cultivation mosaics then this can be used with pioneer shifting cultivation—i.e. first time cleared, as the net effect will not be the C stock of the forest to begin with but the C stock of initial forest minus the long term</p>	<p>DNV GL observed during the audit the initial biomass establishment in relation to the biomass collection in the different shifting cultivation areas, which contain both recent and fallow areas of different ages. The work is not yet completed and full analyses of both the biomass data collection and the actual biomass calculations are to be completed during 2015.</p> <p><b>CAR be closed out during next verification</b></p> <p><b><u>Audit result Year 5 Audit</u></b> DNV GL observed during the audit the initial biomass establishment in relation to the biomass collection in the different shifting cultivation areas, which contain both recent and fallow areas of different ages. The work is not yet completed and full analyses of both the biomass data collection and the actual biomass calculations are to be completed during 2015.</p> <p><b>CAR remained open and will be verified during the next audit.</b></p> <p><b><u>Audit results Year 6 audit</u></b> GFC has started work on the re-stratification of its forest types however due to the delays with the Norway /Guyana Agreement and the priorities for the Year 6 reporting the CAR has not been fully implemented.</p> <p><b>CAR remained open and will be verified during the next audit.</b></p>

CAR ID	Major/Minor	Corrective action request	Response by Project Participants	DNV GL's assessment of response by Project Participants
			<p>average C stock of the Shifting Cultivation cycle.</p> <p>Additionally, the results that the Remote Sensing analyses can reliably deliver on SA will be reassessed and this will be used with the EF to derive carbon impact in these areas.</p>	

## Observations

OBS ID	Corrective action request	Response by Project Participants	DNV GL's assessment of response by Project Participants
Obs1	N/a		

## MINOR Corrective action requests and Observations of the previous year's audit

CAR ID	Major/Minor	Corrective action request	Response by Project Participants	DNV GL's assessment of response by Project Participants
<b>CAR 2</b>	<b>MINOR</b>	<p><b>Requirement:</b> 1.1, 2.1, 2.2, 2.3 and 2.4</p> <p><b>Non-Compliance:</b> Historical GIS layers not confirm the Y5 RapidEye images in some cases.</p> <p><b>Objective evidence:</b></p> <ul style="list-style-type: none"> <li>□ In some areas the GFC GIS layers show a significant shift (of up to 60 meters) (e.g. tile 214308, west side; tile 2140704) with the Y5 RapidEye images. The current mis-registration of GIS layers with the imagery could cause new deforestation or degradation to be missed, when it, due to these issues with registration, seems to coincide with already existing neighbouring deforestation/degradation and thus would be disregarded because of apparently no change. For Y5 RapidEye updated the positional accuracy for Guyana, resulting in an</li> </ul>	<p>It was recognized that when the base map was updated from Landsat to RapidEye full coverage, it would produce an offset/shift with the historical change mapped. To correct for this misalignment, each GFC Analyst was required to shift all historical change to fit the 2014 RapidEye imagery for each tile they were tasked with mapping before they started to digitize/map Year 5 change.</p> <p>We do recognize however that in identified areas, elements of the historical change remain misaligned with the 2014 RapidEye. To correct for this misalignment, the following is proposed and will be pursued in MRVS Year 6: Before the commencement of the year 6 mapping it is planned that each mapping analyst go through each RapidEye tile and manually correct for each misalignment found with the historical change and the 2014 RapidEye. The analyst would use the same approach for mapping new change (systematically go through tile by tile) except in this instance, they would be correcting the</p>	<p>DNV GL has checked the update made by GFC and found that the implemented corrections were adequate with the reporting needs.</p> <p><b>CAR Closed</b></p>

CAR ID	Major/ Minor	Corrective action request	Response by Project Participants	DNV GL's assessment of response by Project Participants
		<p>offset (compared to Y4) for some areas up to 30 meters (according to p. 12). This could be the root cause of this shift. However, whatever the cause, to ensure accurate mapping for Y6 the GIS layers of GFC should match the future RapidEye images.</p>	<p>historical change and ensuring that it is properly aligned with the 2014 RapidEye imagery.</p> <p>As a secondary consideration there will be some exploration of the possibility of ordering the RapidEye 3B product which was used in 2013, as this aligns with historical change (this however would mean that GFC cannot use the updated base map and would need to align all change mapped for year 5 to the imagery (RapidEye 3B product) before GFC proceeds to do year 6 mapping). This is not the preferred option but will be explored to establish the pros and cons before a final decision is take on the next steps.</p> <p>Further the GFC would be assessing whether year 6 or future RapidEye would be referenced to the same coordinates as year 5; also that any other imagery would also fit with the Year 5 image and derived map data.</p> <p>The SOP &amp; QC rules may benefit from an update where historic GIS could be updated to reflect any shift in the current year's satellite imagery. E.g. for Year 6 data (where applicable) historic GIS will be shifted to show consistency with Year 6 imagery. In terms of the SOP, this step will go in the pre-processing stage (before digitising Year 6 change) so not to double count or misclassify any current changes.</p> <p>We also note that shifting is very common between different sensors and also from year to year as ground control points are updated. GFC has dealt with this issue in several examples over Phase 1 (Years 1 to 4 of the MRVS) and through consistent QC and results from the AA, image shifting has not been an issue where the reported figures are significantly inconsistent.</p> <p>We propose to continue using this approach moving forward as we are faced with similar challenges.</p>	
<b>CAR 3</b>	<b>MINOR</b>	<p><b>Requirement:</b> 1.1  <b>Non-Compliance:</b> SOP are not followed in all events  <b>Objective evidence:</b></p>	<p>In improving the MRV system the SOP guiding the implementation has to be updated from time to time. One such improvement is the updating of the QA/QC section of the SOP which was added in August 2015. Important to note is that this modification was done</p>	<p>DNV GL has examined the revised SOPs and has verified that effective revisions have been made to address the Non-Compliances identified within the CAR, including threshold levels for allowable errors, a spreadsheet record of the QA/QC carried</p>

CAR ID	Major/ Minor	Corrective action request	Response by Project Participants	DNV GL's assessment of response by Project Participants
		<ul style="list-style-type: none"> <li>□ During the audit it was found that as part of the rechecks SOP instructions on Page 62 of the SOP for Carbon Measurements were not followed i.e.:               <ul style="list-style-type: none"> <li>○ When the two measurements of DBH are with the allowable error range, the average of the two values is entered in the carbon calculator workbook (with notation made to indicate this was done)</li> <li>○ Any error exceeding allowable limits will be used to calculate measurements error as described below and the identified errors should be corrected.</li> </ul> </li> </ul> <p>No record of the errors found during the QA&amp;QC were found as outlined in Page 68 of the SOP for Carbon Measurements.</p>	<p>after the data on the medium potential for change area was collected. The procedure will however, still be applied to this data and will be reported in the final report on the carbon stocks assessment after all biomass data is processed for the MRV Phase 1.</p> <p>Since the data for the low potential for change is still being processed including the rechecks, this modification to the SOP will be applied to this data set.</p> <p>A tab will be created in the tool itself to track the errors of data entry during the rechecks also applicable to the low potential for change stratum.</p> <p>We also plan on conducting a continuous programme of training of new and current staff to keep staff abreast of all relevant areas of the FCMS. We note that in some cases, these will need to be refresher courses, and in other cases, courses on new developments and areas.</p> <p>In general, we would like to note that in our assessment, field errors are minimal and do not affect in any substantial way, the results and analysis.</p>	<p>out, and a summary of the resulting error determination for each of the carbon pools within each strata of the entire forest carbon monitoring system to date.</p> <p><b>CAR Closed</b></p>
<b>CAR 4</b>	<b>MINOR</b>	<p><b>Requirement:</b> 1.1, 2.1, 2.2, 2.3 and 2.4 <b>Non-Compliance:</b> RapidEye co-registration indicates misalignment leading to shifts between RapidEye images</p> <p><b>Objective evidence:</b> For several RapidEye tiles, images for one tile taken at different dates in Y5 don't exactly match. For example between 2140602_2014-11-12_RE3_3A_298743 and 2140602_2014-11-16_RE2_3A_298743, the latter is shifted approximately 3 pixels (15 meter) to the east.</p>	<p>The GFC has taken note of this issue and determines this matter to only prevail on a small scale and does not affect the main results and analysis.</p> <p>This is an important matter however, for the future improvement of the MRVS and to correct this issue we propose the following:</p> <p>Consult with RapidEye to inquire if it is possible for them to correct the mis-alignment between scenes of imagery obtained for the same tile.</p> <p>Use the Georeferencing tool present in ArcGis to align imagery. The approach would be to check for the RapidEye tile/image that is best aligned with both</p>	<p>The GFC has moved away from Rapid Eye and the current Sentinel 2 has a lower risk in terms of its alignment due to its uniform protocol applied by Sentinel 2. However, as the current QA/QC does not contain any requirements to check whether new imagery providers may re-introduce similar potential error as observed within the use of Rapid Eye. A new CAR was issued to reflect this non-compliance</p> <p><b>CAR to be closed and replaced by a new CAR 4</b></p>

CAR ID	Major/ Minor	Corrective action request	Response by Project Participants	DNV GL's assessment of response by Project Participants
			<p>historical and Year 5 change and shift all other imagery collected for this area to align them with the selected image (this would be done by doing a point shift).</p> <p>The GFC will consider ordering RapidEye swats and re co register imagery and forward the GCP's to RapidEye (this however does not guarantee that all images for the same area will line up, it is also time consuming). Thus, this is not the preferred option but will be examined nevertheless, as one alternative.</p> <p>In conclusion, the GFC notes that shifting of coincident tiles from the same year/delivery is an issue with the RE imagery provided to GFC. However, as a response for Year 6/Phase 2 development we will include an additional level of QC which will look at consistency of coincident tiles (mosaicked geo referenced products). Where tiles are offset we can apply a correction to align them correctly and/or inform RE of the misalignment should the number of tiles affected. The latter will likely be used should the issue be on a larger scale.</p>	




## Observations

OBS ID	Major/ Minor/ Obs	Corrective action request	Response by Project Participants	DNV GL's assessment of response by Project Participants
<b>Obs 1</b>	<b>OBS</b>	<p><b>Requirement:</b> Overall Guyana MRV programme</p> <p><b>Potential Non-Compliance:</b> QA&amp;QC will lead to additional costs and repeat activities</p> <p><b>Objective evidence:</b> Current Re-check application of Biomass does not necessary clearly outline why the second review team is considered over ruling or the relation to the significance of the error within the overall objective to establish biomass volumes for different forest types.</p>	<p>We note this observation and would conduct the necessary follow up to address this.</p> <p>The GFC will work to further develop the blind checks as currently outlined in the SOPs:</p> <p>In areas such as Guyana where plot locations are widely disbursed, and travel to plots may take multiple days, it may not be feasible to have separate crews conduct blind checks on 10% of plots. Where this is the case, an alternative is to conduct blind checks with the same crew, but with members performing different tasks than during initial data collection – however tree spotters must remain identifying trees as this is a unique skill. This is followed by a series of steps given in detail in the SOPs.</p> <p>The point (referred to as Objective evidence), with this outlined approach, will not lead to any one value over-ruling another and it will ensure that all measurements are correctly taken and recorded. The quantification of measurement error will then feed into further sensitivity analyses to identify if this source of error is important or not and how it will affect overall uncertainty as quantified by a Monte Carlo type of analysis.</p>	<p>GFC has included within the SOP a number of QA/QC procedures which provide quantified limits around accepting or rejecting errors that have been found as part of the QA/QC process.</p> <p><b>Observation: Closed</b></p>

<b>OBS ID</b>	<b>Major/Minor/Obs</b>	<b>Corrective action request</b>	<b>Response by Project Participants</b>	<b>DNV GL's assessment of response by Project Participants</b>
<b>Obs 2</b>	<b>OBS</b>	<p><b>Requirement:</b> Interim Measures 2.2 and 2.4</p> <p><b>Potential Non-Compliance:</b> Original hypotheses around forest stratification (grouping of forest types) not confirmed in final stratum.</p> <p><b>Objective evidence:</b></p> <p>Originally GFC demonstrated and argued that carbon content within different forest types were negligible and as such could be group all under forest. However, this was based on data collected predominantly within the traditional forest logged by commercial operations. Now that new data is getting available from the savannah areas (in LPfC stratum) where forest types appear to have lower carbon content, it is not clear if this original conclusion to group all forest types together holds true.</p>	<p>It is intended that following the completion of the three phases of data collection, matters such as those outlined in the objective evidence will be examined. One approach is to consider post stratification of the LPfC area where this matter seems to be prevalent.</p> <p>We note that this was not an issue in the other two strata of HPfC and MPfC where there are multiple forest types and a prevalence of logged and unlogged forest, along with other land use and land management activities.</p> <p>GFC will collate the results of the data analysis from the LPfC stratum and examine this further.</p> <p>This will be further examined in Year 6.</p>	<p>GFC has undertaken a re-stratification with the focus on the risk on degradation, however it does not yet include an assessment on whether the assumed carbon content within forest types requires update.</p> <p><b>Observation remains open</b></p>

## Corrective action requests this year's audit

<b>CAR ID</b>	<b>Major/Minor/Obs</b>	<b>Corrective action request</b>	<b>Response by Project Participants</b>	<b>DNV GL's assessment of response by Project Participants</b>
<b>CAR 1</b>	<b>MAJOR</b>	<p><b>Requirement:</b> Overall MRV Report</p> <p><b>Non-Compliance:</b> Report consists of instances of data not matching.</p> <p><b>Objective evidence:</b></p> <ul style="list-style-type: none"> <li>□ See e-mail of 16 February Vincent Schut to Pradeepa Bholanath seeking clarification on</li> </ul> <div style="text-align: center;">  <p>questions and comments on the report</p> </div>	<p>Edits have been integrated in the Version 3 of the MRVS Year 6 Report to address the comments and questions raised.</p>	<p>DNV GL assessed the changes to the report and is satisfied with the modifications made by the GCF.</p> <p><b>CAR is closed</b></p>
<b>CAR 2</b>	<b>MAJOR</b>	<p><b>Requirement:</b> 2.1, 2.4 and 2.5</p> <p><b>Non-Compliance:</b> Incomplete SOP of mapping</p>	<p>The Mapping SOP will be updated in 2018 to reflect the change in the degradation method. As part of that process GFC will provide additional documentation that outlines</p>	<p>DNV GL accepts the proposed changes and actions proposed by GFC.</p>

CAR ID	Major/ Minor/ Obs	Corrective action request	Response by Project Participants	DNV GL's assessment of response by Project Participants
		degradation & deforestation <b>Objective evidence:</b> <ul style="list-style-type: none"> <li>□ Current SOP does not address the changes that have been adopted in relation to the determination of degradation</li> <li>□ Current SOP makes reference to Rapid Eye applicability whilst this is no longer used.</li> </ul>	the approach. This will include supporting analysis of field measurements collected across sites representative of degradation. Inclusion of text and materials to ensure the approach is well documented and can be replicated in the future.  For Year 7, national data on forest degradation will be estimated from a stratified random change sample. The reference data used for the analysis will be PlanetScope, Sentinel and, where available, GeoVantage aerial imagery.  The SOP will be updated to clarify that RapidEye data has been superseded with more recent earth observation satellites. The documentation that relates to the image processing chain will also be adapted to more accurately reflect current use of freely available image sources and subsequent improvements that are being made to image analysis processes.	Based on the proposed correction the Major CAR can be downgraded to a MINOR and its implementation of the proposed corrections will be verified during the next audit  <b>CAR now a MINOR</b>
<b>CAR 3</b>	<b>MAJOR</b>	<b>Requirement:</b> 2.1, 2.4 and 2.5 <b>Non-Compliance:</b> Accuracy Assessment have become part of value determination instead of quality control <b>Objective evidence:</b> <ul style="list-style-type: none"> <li>□ With the adoption of the sampling technique of the degradation through the accuracy assessment team the degradation value is not subject to the same level of independent assessment as the deforestation data receives through the accuracy assessment.</li> </ul>	The element of independent assessment of the change data will be reintegrated in year 7.  It is intended that the revised degradation methods will be routinely applied to future years. To enable this GFC will develop in conjunction with Durham University a training module that allows the estimation or 'accuracy assessment' methods to be replicated at GFC.  An innovation for Year 7 will be the development of a new SOP that will allow GFC staff to conduct the change interpretation part of the forest degradation estimation process. GFC staff will be trained in the use of the reference data and the methodology for change assessment using the bespoke GIS toolbar.  Durham University will then be provided with the change data and will undertake the statistical analysis of the forest degradation results and provide tabular	DNV GL accepts the proposed changes and actions proposed by GFC.  Proposed action provide assurance that the independent assessment carried out by the Durham University for all its assessment activities. Whilst the proposed training will put in place capability of the GFC staff to implement the newly adopted degradation method. Based on the proposed plan MAJOR CAR is to be downgraded to a MINOR and full implementation and effectiveness will be verified during the next audit.  <b>CAR now a MINOR</b>

CAR ID	Major/ Minor/ Obs	Corrective action request	Response by Project Participants	DNV GL's assessment of response by Project Participants
			<p>data/analysis for reporting purposes.</p> <p>In so doing, Durham University will continue to support the approach and will be responsible for auditing the GFC's interpretation of change and associated deforestation and degradation estimates. In this way the process supports GFC to attain the necessary skills required to perform the assessment while also incorporating the independent verification process – which is an integral part of the MRVS. The accuracy assessment report will be replaced with an independent report on GFC's results estimates by Durham University</p>	
CAR 4	MINOR	<p><b>Requirement:</b> 1.1, 2.1, 2.2, 2.3, 2.4, 2.5 and 2.6</p> <p><b>Non-Compliance:</b> Lack of clarity in SOP and Report that minimum acceptable mapping requirements for the information needs of GFC remain fulfilled.</p> <p><b>Objective evidence:</b></p> <ul style="list-style-type: none"> <li>□ With the increasing developments around images that are available in the open source market and commercial market and the GFC's adoption of some of these elements in Year 6, the GFC needs to more effectively justify that the existing defined minimum criteria of the MRVS remain fulfilled under the new technologies that have been used and that these meet the needs of GFC to continue its reporting requirements under the UNFCCC and/or Donor Countries.</li> <li>□ Current SOP does not contain QA/QC controls to verify that images may not be correctly aligned over time.</li> </ul>	<p>The GFC recognises the fast pace that new sensors are becoming available. We intend to add clarity in both the SOP for Mapping as well as in future Reports that document the integrating of these developments.</p> <p>A fuller justification will be provided, including a checklist with test scenarios that the new developments meet the defined minimum criteria of the GFC's MRVS which include: fulfilling the requirements of the SOP for Mapping, remaining consistent to the definition of forest, and uniformly applying the MMU.</p> <p>Additionally, structural changes will be made to the Year 7 and future reports to more effectively present these new developments and show how they are synergistic to the existing main tenants (including defined minimum criteria) of the MRVS.</p>	<p>DNV GL agrees with proposed planning of GFC however the CAR will not be closed till the next verification once the evidence of the implementation can be verified.</p> <p><b>CAR to be closed out during next verification</b></p>
CAR 5	MINOR	<p><b>Requirement:</b> 1.1, 2.1, 2.2, 2.3 and 2.4</p> <p><b>Non-Compliance:</b> No operational linkage between CMRV and the national MRV</p> <p><b>Objective evidence:</b></p> <ul style="list-style-type: none"> <li>□ Although initial capacity building, training, and data-gathering exercises have commenced and</li> </ul>	<p>The Office of Climate Change is the lead agency coordinating the implementation of the Opt In Mechanism.</p> <p>The GFC is not the lead agency for this REDD+ activity.</p> <p>The GFC will support the implementation of the Opt In</p>	<p>DNV GL agrees with proposed planning of GFC however the CAR will not be closed till the next verification once the actions can be verified.</p> <p><b>CAR to be closed out during next verification</b></p>

CAR ID	Major/Minor/Obs	Corrective action request	Response by Project Participants	DNV GL's assessment of response by Project Participants
		<p>continued between GFC and its partner organizations implementing the CMRV progress with local Amerindian communities, no operational link between the monitoring or with the data gathered and the greater MRVS system has been made to date, nor has there been any progress made with regards to the opt-in mechanism and a corresponding pilot program, which according to the JCN, should have commenced in 2015.</p> <p>□ JCN Table 1 key REDD+ enabling Efforts. requires the start of a pilot during 2015 for the Opt-In Mechanism. However, the verification team realizes that the GFC and its corresponding Ministry have undergone a restructuring where by some of the Ministries responsibilities may have moved to Office of Climate Change, hence the team seeks further information on how and if the GFC will support the new government body with the implementation of the JCN requirements.</p>	<p>as it advances however, with the Commission not being in the leadership role in this project, the GFC cannot dictate the pace or method of implementation.</p> <p>The GFC stands ready to support the Opt In in any way requested. The Commission will look out for those requests.</p> <p>Notwithstanding this, the GFC will continue to work with partners, including the WWF, on CMRV related work as far as practicable whilst the Opt In evolves to a piloting status. This work will seek to support the national MRVS and vice versa. The Commission is careful to not create a parallel/divergent track to what may be required under an Opt In mechanism and for this reason stand ready to support this process when needed and in the way needed.</p>	

OBS ID	Major/Minor/Obs	Corrective action request	Response by Project Participants	DNV GL's assessment of response by Project Participants
Obs 1	OBS	<p><b>Requirement:</b> Overall Guyana MRV programme</p> <p><b>Potential Non-Compliance:</b> Potential miss understanding by stakeholders on how the applied MRV methodology is driven by existing experience and knowledge within the programme</p> <p><b>Objective evidence:</b></p> <p>Currently the programme is still modifying its methodology to incorporate the changes away from RapidEye and Geovintage. Although this may have impact in actual data there is a need to verify that methodology remain consistent with the build-up</p>	<p>Since 2009 GFC has progressively improved the MRVS to recognize changes in data availability, improvements in sensor's spatial and temporal resolution. It is envisaged that GFC will continue to take advantage of new technologies and as appropriate add these to the MRVS. As new elements are added these are rigorously tested by GFC to ensure that they meet the established MRVS reporting standards and interim measures. Compliance against these standards and measures is verified annually through the accuracy assessment and</p>	<p>DNV GL agrees with proposed planning of GFC during the upcoming audit the Audit team will pay additional attention to this area.</p> <p><b>Obs to be verified during next audit</b></p>

OBS ID	Major/ Minor/ Obs	Corrective action request	Response by Project Participants	DNV GL's assessment of response by Project Participants
		experience to date.	<p>audit process.</p> <p>In 2018 GFC plan to update the existing SOP to reflect the changes incorporated to ensure that any new methods adopted are well described and able to be replicated. Some amount of structural modifications will also be made to the Year 7 Report to focus more on the current work and approaches whilst showing that the methods applied remain consistent.</p>	
<b>Obs 2</b>	<b>OBS</b>	<p><b>Requirement:</b> Standard Operating Procedures for Forest Carbon Monitoring System</p> <p><b>Potential Non-Compliance:</b> Unaccounted for update claims to Standard Operating Procedures</p> <p><b>Objective evidence:</b></p> <ul style="list-style-type: none"> <li>□ The MRVS Interim Measures Report Year 6 makes the following claims for the Year 6 period, yet no evidence has been provided to substantiate these measure have been enacted: <ul style="list-style-type: none"> <li>○ Review and revision conducted of the Standard Operating Procedures to address enhanced synergies (pg. 4).</li> </ul> </li> </ul> <p>The facilitating of data sharing between agencies through inter - agency training (pg. 63).</p>	<p>The GFC has revised the SOP for the FCMS to allow for more effective synergies to be achieved across data collection, cross checking of data and how rechecks are treated. These were demonstrated to the Verification team. Prior to this, there was ambiguity on how rechecks were to be treated and the role of amalgamation of all rechecks results in the main summary. This was addressed and concluded in year 6.</p> <p>Over the year 6 period, the GFC supported a range of requests for MRVS related data, including but not limited to:</p> <ul style="list-style-type: none"> <li>- The Guyana Energy Agency's request for the Digital Elevation Model generated by the national MRVS to help with the determination of areas of high hydrological potential.</li> <li>- GFC supported the sharing of data regarding a project on the mining sector. This project is aimed at fostering greater responsibility and sustainability for Guyana's artisanal, small and medium scale gold mining industry. The GFC provided historical deforestation data on the project site which is the Mahdia areas to an extent of 15km radius. The GFC also provided the shapefiles and results tables on drivers of forest change. It was indicated that the data will assist in facilitating the overlaying, testing and analyzing of spatial maps to enable the analytical work of the project to be done.</li> <li>- Support to Region 9 Municipal Planning Meeting - a map showing deforestation for Region 9 was developed and presented at the Meeting for</li> </ul>	<p>DNV GL has assessed the additional information provided by the GFC after the closing meeting and determined that provided evidence adequately outlines the sharing of data among the various agencies.</p> <p><b>Obs has been closed</b></p>

<b>OBS ID</b>	<b>Major/ Minor/ Obs</b>	<b>Corrective action request</b>	<b>Response by Project Participants</b>	<b>DNV GL's assessment of response by Project Participants</b>
			<p>Councilors.</p> <ul style="list-style-type: none"> <li>- Assessment of the CMRV model for 17 forest based communities was conducted and shared with WWF which presents the performance based system under the national MRVS scaled down for each individual community.</li> </ul> <p>These were all completed in year 6 and informed the GFC's statements in Report which accurately reflect the body of work done.</p>	

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## **APPENDIX B**

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### **CURRICULA VITAE OF THE VERIFICATION TEAM MEMBERS**



## **Edwin Aalders**

*Mr Aalders has 20 years of experience as an assessor in Environmental Auditing and Policy and Management. Mr Aalders started his career in SGS in 1992 where he quickly became involved in the development of new environmental certification & control services. In 2004 he became the Director of the International Emission Trading Association (IETA) which he held till 2009. In addition to his role as Director in IETA he was the first CEO for the Verified Carbon Standard Association (VCSa) between November 2007 and October 2008. After leaving IETA Mr Aalders became a Partner with IDEACarbon before joining DNV GL as at their Climate Change and Sustainable Development Department in 2011.*

*Throughout his career Mr Aalders lived and worked in the various developing and developed countries, particularly Latin America, Africa and Australasia, involved in developing new environmental markets services. At SGS his work covered the development of environmental programmes such as SGS' Services in for Climate Change, Marine Stewardship Council (MSC), Organic, GLOBALGAP and Forest Stewardship Council (FSC). Whilst within IETA he had the operational responsibility of IETAs overall activities and in particular those related to the UNFCCC process (CDM & JI) as well as the voluntary market which ultimately led to the setting up of the VCSa.*


*Mr Aalders is and has been an elected member of roster of experts for the Methodology & Accreditation Panel Expert of the CDM & JI, member of the JI Accreditation Panel, and is currently member of the VCSa AFOLU Steering Committee and WOCAN.*

## **Vincent Schut**

*Vincent Schut has over 10 years' experience in earth observation image analysis and received his MSc in Tropical Agriculture at Wageningen University in 2001. At Satelligence, he coordinates the development of advanced optical image processing chains and supporting algorithms and software for semi-automated forest and land cover change monitoring in tropical forest areas. Vincent is an experienced programmer (python, idl, C, C++, java) working with Quantum GIS, openJump. Over the years he has executed several field work campaigns in South East Asia and has good knowledge of the relation between imagery and land cover characteristics. He has successfully executed image processing assignments in support of national REDD MRV system development in Suriname, Colombia and Indonesia as well as private sector VCS projects.*

## **Pablo Reed**

*Pablo Reed holds more than 15 years of experience in the fields of Forestry, Climate Change, and International Development. He holds a joint degree in Forest Engineering and Latin-American studies from the University of Washington, as well as a Masters in Environmental Management from the Yale School of Forestry and Environmental Studies. His interest and passion for conservation and development initiatives have led him to work in various countries and projects through the years, such as serving as country director for a USAID-led indigenous community mapping program in Guatemala; as an environmental consultant for the Academy of Educational Development in Panama; and as director for the Natural Resource Conservation Program with the Peace Corps in Ecuador. He joined DNV GL in 2011, where his work mainly concentrated on the validation of Agriculture, Forestry, and Other Land Use (AFOLU)-sector carbon offset projects across the globe, and on Low Emissions Development Strategies (LEDs) and the design of Nationally Appropriate Mitigation Actions (NAMAs) for emerging economies in Latin America. Since his departure from DNV-GL in 2015, he now works as an independent consultant*



*and is currently based out of Sonoma County, in Northern California. His main areas of interest and expertise concentrate on issues of community-based conservation, non-traditional land tenure arrangements, and the feasibility of incorporating indigenous community lands under Reducing Emissions from Deforestation and Degradation (REDD) and other payment-for-environmental-services type of initiatives.*

**Dr Misheck C Kapambwe**

*Dr Kapambwe has over 20 years international experience in the fields of forestry, forest products processing and management, environmental management and resource conservation, climate change policy, climate change consulting, and academia. He holds a PhD in forest products carbon accounting and a Master's Degree in Wood Science from the University of Melbourne (Australia), a Master of Business Administration (Sustainable Business) Degree from the University of South Australia (Australia), and also holds a Graduate Diploma in Forest Industries (Australia), a Diploma in Forestry (Zambia) and a Diploma in Sawmilling Technology (Zimbabwe)*

*He has worked in both developed and developing countries, accumulating many years of experience as AFOLU methodology validator, as well as auditor, validator and verifier of numerous international forest carbon projects including REDD+ projects under CDM program, VCS, CCBA and ISO 14064 Standards. He has also worked in academia as Research Fellow, Dean of Postgraduate School and Lecturer in the areas of environmental management, development studies and Sustainable Development.*

*He now works as independent environmental and compliance consultant for climate change mitigation and adaptation projects as well as other natural resources management projects. His qualification, industrial experience and experience in forestry and forest industries demonstrate his sufficient sectoral competence in forestry (technical area & sectoral competence TA 14.1 & Sectoral Scope 14).*



## **About DNV GL**

Driven by our purpose of safeguarding life, property and the environment, DNV GL enables organizations to advance the safety and sustainability of their business. We provide classification and technical assurance along with software and independent expert advisory services to the maritime, oil and gas, and energy industries. We also provide certification services to customers across a wide range of industries. Operating in more than 100 countries, our 16,000 professionals are dedicated to helping our customers make the world safer, smarter and greener.