VERIFICATION REPORT

VERIFICATION OF INTERIM REDD+ PERFORMANCE INDICATORS UNDER THE GUYANA-NORWAY REDD+ PARTNERSHIP

Monitoring Period:
1 October 2010 to 31 December 2011 – Year 2

REPORT NO. 2012-1402
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DET NORSKE VERITAS

VERIFICATION REPORT

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Approved by	Organisational unit: DNV KEMA Energy & Sustainability
Client: Ministry of Environment– Government of Norway	Client ref.: Maarten van der Eyden / Andreas Tveteraas

Summary:

DNV KEMA Energy & Sustainability AS (DNV) has been commissioned by the Ministry of Environment– Government of Norway to perform a non-accredited verification of the Interim Performance Indicators reported for the period 1 October 2010 to 31 December 2011 – Year 2 as described in the Guyana REDD+ Monitoring Reporting and Verification System (MRVS) - Interim Measures Report, Version 26 July 2012 produced by the Guyana Forestry Commission – Government of Guyana.

This report provides the verification methodology, results and statement.

Report No.: 2012-1402	Subject Group: Environment

Indexing terms

Key words	Service Area
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	Market Sector
	Forestry

Report title: Verification of Interim REDD+ Performance indicators under the Guyana-Norway REDD+ partnership	

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DNV VERIFICATION STATEMENT

Verification Objective

DNV Climate Change Services AS (DNV) has been commissioned by the Norwegian Ministry of Environment[*] to perform a non-accredited verification of the Interim Performance Indicators under the Guyana-Norway partnership on REDD+ as reported in the Interim Measures Report[†]

Verification Scope

The scope of the verification covers the following deforestation and degradation indicators.

Deforestation Indicators	Indicator 1: Gross Deforestation rate in Year 2
Degradation Indicators	Indicator 2a: Loss of intact forest landscapes
	Indicator 2b: Carbon loss as indirect effect of new infrastructure.
	Indicator 3: Forest Management
	Indicator 4: Emissions resulting from illegal logging activities.
	Indicator 5: Emissions resulting from anthropogenic forest fires.

In addition, DNV 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 time period covered is 01 October 2010 – 31 December 2011 (Year 2).

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. This does not include individual or aggregate level of error associated with technical equipment (e.g. sensors) or remote sensing methods (e.g. visual interpretation). However, for Indicator 1 – gross deforestation rate, this has been addressed by an independent accuracy assessment.

Verification criteria

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

- 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).
- GOFC-GOLD REDD Source Book (2009).
- 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.
- Good Practice Guidance for Land Use, Land-Use Change and Forestry (2003).

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[*] Contract and scope signed between The Norwegian Ministry of Environment and DNV on 10 January 2011
[†] Guyana REDD+ Monitoring Reporting and Verification System (MRVS) - Interim Measures Report, Guyana Forestry Commission, 16 March 2011

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 01 July 2012 until 16 September 2012 and included desk reviews of relevant documentation and datasets as listed in the verification report and an on-site assessment in Guyana from 16 July 2012 to 21 July 2012.

As part of the verification, the results of the independent accuracy assessment included in the Interim Measures Report dated 13 July 2012 were verified.

Conclusions

It is DNV's opinion that the results provided in the Interim Measures Report by Guyana Forestry Commission dated 26 July 2012:

- 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 has verified that the values for the interim indicators in Year 2 monitoring period (01 October 2010 to 31 December 2011) are:

Indicator		Year 2 results
Indicator 1:	Gross Deforestation rate in Year 2	0.054%
Indicator 2:	Loss of intact forest landscapes	5.59 million ha
Indicator 2b:	Carbon loss as indirect effect of new infrastructure.	5 460 ha
Indicator 3:	Forest Management	3 685 376 tCO$_2$
Indicator 4:	Emissions resulting from illegal logging activities.	18 289 tCO$_2$
Indicator 5:	Emissions resulting from anthropogenic forest fires.	28 ha/year

Statement Issuing date
16 September 2012

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

Abbreviations

ALOS AVNIR2	Advanced Land Observing Satellite Advanced Visible and Near Infrared Radiometer type 2
AVHRR	Advanced Very High Resolution Radiometer
ASAR	Phased Array Type C-band Synthetic Aperture Radar
CAR	Corrective Action Request
CBERS	China Brazil Earth Resource Satellite
CBM	Cubic Meter
CH_4	Methane
CL	Clarification request
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
CoC	Chain of Custody
DMC	Disaster Monitoring Constellation
DNV	Det Norske Veritas
DOS	Dark Object Subtraction
EVI	Enhanced Vegetation Index
FAR	Forward Action Request
FIRMS	Fire Information Resource Management System
GFC	Guyana Forestry Commission
GHG	Greenhouse gas(es)
GIS	Geographic Information System
GOES	Geostationary Operational Environmental Satellite
GOFC-GOLD	Global Observation of Forest Cover - Global Observation of Land Dynamics
GPG	Good Practice Guidelines
GWP	Global Warming Potential
IFL	Intact Forest Landscapes
IMR	Interim Measures Report
INPE	Instituto Nacional de Pesquisas Espaciais
IRS	Indian Remote Sensing Satellite
JCN	Joint Concept Note
MMU	Minimum Mapping Unit
MODIS	Moderate Resolution Imaging Spectroradiometer
MP	Monitoring Plan
MRVS	Monitoring Reporting and Verification System
P1	Benchmark Period 1 – from 1990 to 2000
P2	Benchmark Period 2 – from 2000 to 2005
P3	Benchmark Period 3 – from 2005 to 2009
PIF	Pseudo Invariant Features
QA/QC	Quality Assurance / Quality Control
REDD+	Reducing Emissions from Deforestation and Degradation
RP	Responsible Party of the assertions - GFC
RSB	REDD Sourcebook
SOP	Standard Operating Procedures
SPOT	Satellite Pour l'Observation de la Terre
TOR	Terms of Reference

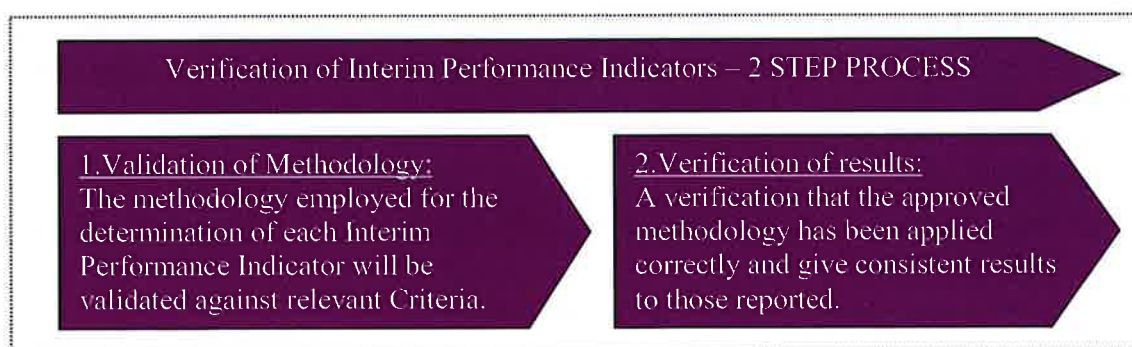| UNFCCC | United Nations Climate Change Convention |
USGS	United States Geological Survey
VCS	Verified Carbon Standard GHG programme
Year 2	Second monitoring period from October 1, 2010 to December 31 2011

1 INTRODUCTION

DNV 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 /45/.

DNV has been tasked to verify the results in deforestation and forest degradation as measured using the interim indicators established in the Joint Concept Note, specifically as outlined below and as detailed in the JCN Table 2, pages 16-20 /45/:

1. Gross Deforestation in the period from 1 October 2010 to 31 December 2011 (Year 2);
2. Loss of intact forest landscapes;
3. Forest Management;
4. Carbon loss as indirect effect of new infrastructure;
5. Emissions resulting from illegal logging activities;
6. Emissions resulting from anthropogenically caused forest fires;

2 BASIS OF VERIFICATION

In order to verify the Interim Performance Indicators, DNV 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.

Verification of Interim Performance Indicators – 2 STEP PROCESS

1. Validation of Methodology:
The methodology employed for the determination of each Interim Performance Indicator will be validated against relevant Criteria.

2. Verification of results:
A verification that the approved methodology has been applied correctly and give consistent results to those reported.

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

2.1 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 or 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 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.

2.2 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 (Version 3 of 26 July 2012) 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;

2.3 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) /45/;
  - GOFC-GOLD REDD Source Book, 2011/46/;
  - IPCC Good Practice Guidelines /47//48//49//50/;
  - Approved REDD methodologies under the VCS programme /56/;
  - Peered reviewed publications /32//53/
- Verification criteria:
  - Main Criteria - Joint Concept Note (i.e. Section 3: REDD-plus performance Indicators) /45/;
  - Validated analysis methodology (once validated by DNV) /1/;

2.4 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 TOR of the assignment /51/ and the provisions of the JCN /45/ the scope of the verification consists in the verification of the following deforestation and degradation Interim Measures Indicators as described in the JCN /45/:

Deforestation Indicators   Indicator 1: Gross Deforestation in Year 2

Degradation Indicators   Indicator 2: Loss of intact forest landscapes

Indicator 2b: Carbon loss as indirect effect of new infrastructure.

Indicator 3: Forest Management

Indicator 4: Emissions resulting from illegal logging activities.

Indicator 5: Emissions resulting from anthropogenically caused forest fires.

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*:
    o Monitoring period: Year 2 (1 October 2010 to 31 December 2011)
- *Frequency of subsequent verification processes*: Yearly verification
- *Intended user for the verification statement*: Government of Norway and Government of Guyana

2.5 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"/51/. 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 /51/.

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

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. This does not include individual or aggregate level of error associated with technical equipment (e.g. sensors) or remote sensing methods (e.g. visual interpretation). However, for Indicator 1 – gross deforestation rate, this has been addressed by the independent accuracy assessment/16/.

3   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						
				Administrative	Desk review	Site visit	Reporting	Supervision of work	Technical review	Sectoral competence
Customer manager	Brynestad	Sigrid	Norway	✓						
Technical team leader	Aalders	Edwin	Norway		✓	✓	✓	✓		✓
Independent Expert	Schut	Vincent	the Netherlands		✓	✓	✓			✓
Validator under training	Kapambwe	Misheck	Australia		✓	✓	✓			✓
Internal Peer Reviewer	Espejo	Andrés	Italy						✓	✓

Duration of verification

Preparations:	*From 01 July 2012 to 16 July 2012*
On-site verification:	*From 16 July 2012 to 21 July 2012*
Reporting, calculation checks and QA/QC:	*From 21 July 2012 to 16 September 2012*

3.1   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 IMR /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//21//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.

3.2 Site visit

An on-site assessment was performed from 16 July 2012 to 21 July 2012; partly in GFC's main headquarters located in Georgetown, and partly in GFC's forest stations of Mabura and Bartica. In order to complete the verification and sampling plan to be used during the verification, two scoping sessions were carried out on 16 July 2012. The sessions helped the verification team to understand the methodology applied for the assessment of each interim performance indicators and, in turn, to understand the possible sources of error and where the verification efforts should be concentrated.

After the scoping session and the definition of the final verification and sampling plan, the actual verification on-site assessment was performed on 17 July – 20 July 2012. During these four 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, 2b and 5. This verification took place in GFC's GIS office and by on-site verification in Bartica.

- Team 2 – forest management and illegal logging: This team carried out the verification of Indicators 3 and 4. A verification of GFC's databases was carried out on the last day of the audit, and which was supported by a field visit to GFC's forest stations and was carried out in the forest concession in and around Mabura to allow cross-checking of information.

On 21 July 2012 a closing meeting with a preliminary reporting of the findings of the verification took place in the GFC's headquarters.

3.3 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 4 and findings are listed in Annex A.

4 VERIFICATION FINDINGS

4.1 Interim indicator 1 - Gross Deforestation

4.1.1 Methodology validation

a Methodology description

While the Year 1 method relied completely on medium resolution Landsat images, for Year 2, RP has made the change to use 5 m resolution RapidEye data as a base for the mapping of deforestation and degradation. This change is welcomed by the audit team as it reduces the overall uncertainty and lack of data available from Landsat images since the failure of Landsat 5 in October 2011. RapidEye data was tasked and downloaded for those areas that classified as high-risk areas, defined as those areas that had seen change in Year 1. The total coverage of RapidEye was 56% of Guyana. Landsat 5 and 7 images were downloaded for entire Guyana as backup dataset and to map the low-risk area (the area with no changes in Year 1). For several RapidEye scenes, images from multiple dates were available, thus extending the cloud-free area that could be mapped with RapidEye. Ultimately, 385 RapidEye scenes were acquired and processed. In addition, RP also acquired DMC, IRS, MODIS and ASAR data and used as complementary datasets for those areas that were under persistent cloud cover using the RapidEye data.

The mapping method for Year 2 is focussed on the use of RapidEye data. For the low-risk areas where no RapidEye data was tasked and only Landsat data was available, the same method as in Year 1 was used. It should be noted that the fact that not the total of Guyana has been covered by RapidEye for Year 2 is mainly due to time factors in tasking the RapidEye satellite during Year 2. For Year 3 RP has plans and has initiated steps to have full coverage of Guyana using RapidEye thus allowing the possibility to further reduce the dependence on the use of Landsat images. As of 18 November 2011, Landsat 5 imagery has become unavailable due to failure of an electronic component, which prevented the transmission of images to ground stations. In May 2003, Landsat 7 encountered a scan line correction fault that caused a striping effect on the images.

DNV has observed that the processing and mapping for Year 2 can be summarized by the following steps: 1) pre-processing of RapidEye data; 2) generating EVI based change polygons; 3) manually digitizing forest change and degradation:

1) RapidEye data used and acquired by the RP was defined as a level 3A product, meaning that the data upon delivery to RP is already terrain corrected. As such, the processing of the RapidEye data starts with geo-referencing the data to the 2005 Landsat Geocover base map, which was also used as a baseline for geo-referencing of the earlier mapping data. If multiple images were available for the same area, the image with the most cloud-free area was geo-referenced to the 2005 baseline, and the others were geo-referenced against the initial RapidEye image. RapidEye images from the same track were mosaicked together to form one large image mosaic to ease further processing.

2) Next step in the processing was radiometric normalization by Dark Object Subtraction (DOS) and calculating reflectance values from the raw data values. Then the EVI was calculated. To create a non-forest delineation from the EVI image, the EVI image is

'thresholded' starting with a default value which is then adapted to local scene conditions (e.g. vegetation composition, soil moisture content, shadow) by visual and numerical inspection and comparison of the result and the original DOS-corrected image while checking both forest and non-forest areas and their border. This is possible because in Guyana there is, in general, little to no gradual change from forest to non-forest in deforested areas; the change is normally very sudden. The higher and enhanced resolution of RapidEye in comparison to the Landsat images allows for an accurate delineation of the boundaries between forest and non-forest areas.

3) Once a suitable EVI threshold has been found, the threshold is applied to generate a non-forest image. Then the non-forest areas are filtered (using a clump-and-sieve filter) to get rid of most of the single-pixel noise and polygons are generated from the filtered areas. The resulting polygons are cleaned manually from influence of cloud, shadow, and ultimately intersected with the Year 1 forest map to get only the Year 2 forest change.

The resulting intermediate images from each processing, step and the EVI threshold value used are saved for later reference.

A persistent cloud map is generated with the areas that are cloudy in all available images. For these areas, if possible, alternative imagery is used (e.g. Landsat, IRS, MODIS or ASAR), even though the much lower resolution and different nature of ASAR radar data did not allow for a detailed mapping in these areas. When recent over-flight photos were available, these were used as an additional mapping source. The total area of Guyana that was persistently cloudy in Year 2 comprised 2.9%, and for the high-risk area for which RapidEye data was available, it was 1.3%.

From here, the mapping process is largely the same as in Year 1, except that it is based on the much more detailed results of RapidEye instead of Landsat. DNV confirms that these changes in methodology between Year 1 and Year 2 do not represent a significant change in the methodology applied by the GFC other than that the modifications needed to be able to use the RapidEye images represent an improvement of the accuracy and ability to detect land use changes and identify the driver of change.

The EVI based polygons go into the GIS system, and a GIS operator visits these polygons one by one (in a 1 km x1 km block-wise manner so as to structure the process a bit). Then for each polygon, a visual inspection is done using the original RapidEye image and if necessary other RapidEye images from other dates and/or other imagery. If the polygon coincides indeed with a deforestation event and exceeds the 1 ha MMU, the extent of the polygon is edited (if necessary). In order to establish the changes over time, reference images from the other periods (e.g. P1, P2, P3, Year 1[*]) are used, whereby the current land cover, the driver of the change, a reference to the image on which the change was based and the last image in the database where the area was still forest are entered and saved into the GIS database. As part of the quality control measures set up by GFC, a toolbar has been developed to ease this process and ensure that all data is entered. After all polygons in the block have been inspected, the block is inspected for changes that the EVI threshold might have missed. Areas that are identified as being missed areas of deforestation and that exceed the MMU threshold are consequently mapped and included in the GIS database.

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[*] P1=1990-1999, P2=2000-2005, P3=2005-2009 and Year 1=2009-2010. These periods are defined in Year 1 Verification Report/63/

Finally, before the operator visits the next block, a degradation analysis is done for the newly found areas with the block that represent a change. For this the same toolbar is being used.

DNV has verified this process with the mapping guide (Annex 9 of the report) /1/ and confirms that the team operates in-line with the guide. The system is set up to automate those steps that can be automated, thereby minimizing risk of errors, and the mapping process itself is structured by using a series of toolbars which guides the operator through the process and performs basic checks to ensure that all data has been entered.

b   Validation criteria and Indicators

Criteria noted in the JCN /45/ 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/45/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 /45/, GOFC-GOLD REDD Sourcebook /46/, and UNFCCC Good Practice Guidelines (GPG) /47//48//49//50/) 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 accuracy assessment[*].

c   Validation of methodology against criteria

Generation of deforestation datasets

RP 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 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 REDD sourcebook /46/. The RP applied QA/QC measures through the revisiting of 100% of the 10 km x 10 km grid cells used for aiding the visual interpretation which has been verified as having reduced the human error /1/.

Independent accuracy assessment

The verification team checked the methodology followed for this assessment /16/. According to this document /16/, the accuracy assessment randomly-sampled forested and non-forested locations using 10 km x 10 km grids stratified into regions of high and low risks of

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[*] This accuracy assessment was conducted by the RP and it was conducted as part of mapping quality control and quality assurance (QAQC) to give an understanding of the quality of the mapping and used internally for this purpose. An independent accuracy assessment has been contracted to Durham University.

deforestation based on inclusion of such risk-based criteria as logging camps, settlements of greater than 1 000 persons, mining dredges or intersection with roads or trails using data made available by the RP. Within each sampled grid, a systematic sample of 361 points about 500 m from each other (that were enlarged/buffered into 1 ha sample circles - to meet the MMU) was used for direct manual assessment of cloud-free very high resolution data. In all, a dataset of 18 050 1 ha sample circles were analyzed in a binary fashion to assess the Year 2 deforestation map and using a confusion matrix to measure accuracies.

The methodology followed meet best practice guidelines in terms of sample design and accounting for national conditions and capabilities /46/.

Conclusion

The verification team concluded that considerable progress is being made with the mapping methodology by the introduction of the RapidEye images. The verification team also concludes that the analysis methodology used by the RP meets the applicable criteria, defined by the JCN /45/, GOFC-GOLD REDD Sourcebook /46/, and UNFCCC Good Practice Guidelines (GPG) /47//48//49//50/.

4.1.2 Verification of Indicator

Image processing

Radiometric normalization technique used the Dark Object Subtraction (DOS) /1/. Cloud-shadow masking methods used 'thresholding' in the blue band and additional manual inspection. These methods are adequate and in line with the REDD Sourcebook /46/. Least cloud cover RapidEye input images were selected and geometric correction of images was considered adequate. An examination of a selection of the input satellite scenes demonstrated that the RP had produced products meeting the 1 pixel accuracy, as suggested by guidance materials, for all periods.

Analysis methods

Deforestation in Year 2: Deforestation in Year 2 was obtained through visual interpretation of RapidEye images, guided by automated delineation of forest to non-forest features. Taking into account the fact that the same procedure was used for Year 1 (though using higher resolution images for Year 2), and that an independent accuracy report /16/ 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 the operators demonstrate the entire process for several different areas, and found that the operators followed the SOP. The verification team interviewed the operators and found their level of understanding of the processing and mapping tasks to be very good.

Accuracy assessment

The verification team checked the final results of the independent accuracy assessment performed by the University of Durham /16/ and provided by the RP. According to this assessment the overall accuracy of the Year 2 deforestation mapping is equal to 96.35%, which exceeds the minimum accuracy acceptable for the mapping according to the REDD sourcebook /46/ and other applicable criteria /56/. The verification team has verified the results of the accuracy assessment by having the validation process demonstrated and checked

for 1 validation tile. Also, the excel sheets used to calculate the final accuracy values were inspected and found to be correct.

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 2 is 0.054% (with Year 2 covering actually 15 months).

4.2 Interim indicator 2a - Verification of the Loss of intact forest landscapes

4.2.1 Methodology validation

a Methodology description

The methodology followed by the RP 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 and Year 2 land use layers and excludes them /53/. 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 /53/. 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 10km radius. An assessment is made to ensure that at least a 2 km wide corridors or appendages is observed to and from areas meeting the applicability conditions. All of the buffering, exclusion, areal calculation, and area-based selection are performed using ArcGIS v.10 modeling code /53/. Final identification of polygons meeting suitable width criteria is performed manually. Furthermore, in order to refine the IFL map, cleanup of island polygons which would fail either the 10 km size or 2 km width test was performed.

The RP has included this operation in their procedures (as recommended last year FAR 8 /57/), 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 problem.

New information provided to RP by GGMC indicated that the initial Year 1 IFL area omitted areas allocated to mining reconnaissance and reserve areas. These new areas have been taken into account in both the calculation of the Year 2 IFL and a recalculation of the year 1 IFL to correct the IFL Year 1 benchmark figure.

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) /54/, as referred by JCN /45/. 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 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 km² (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.*/54/ 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.*/54/ 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. /54/. 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 RP meets the definition and concept of Intact Forest Landscape /55/ and is in line with the recommendations of Potapov *et al.* /54/.

4.2.2 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 1 is 5.59 million ha, and that the figure for Year 2 is the same.

4.3   Interim indicator 2b – Carbon loss as indirect effect of new infrastructure

4.3.1   Methodology validation

a   Methodology description

The switch from using medium resolution Landsat images to using high resolution RapidEye images allows for a different approach of degradation mapping than in Year 1. While degradation was hardly visible in Landsat images, it is clearly visible in the RapidEye imagery. While Year 1 degradation mapping was based on the rule of 50% carbon loss within a 500 m buffer around new infrastructure, field studies conducted by RP indicate that for the situation in Guyana, this rule is overestimating the extent of and carbon loss due to degradation.

The Year 2 methodology to calculate the loss of carbon as an indirect effect of new infrastructure was achieved through visual inspection and manual digitizing of degraded areas visible in the RapidEye imagery, within a buffer of 100 m around new Year 2 mining areas and around roads related to mining, forestry, and infrastructure, but excluding existing deforested lands that intersected the degradation buffer (such as those from roads and infrastructures built during P1, P2,/P3 or Year 1) /1/.

b   Validation criteria and Indicators

The main validation criteria is the JCN /45/ 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 /45/ 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 monitoring changes in carbon stocks in forests remaining as forests, and requires medium resolution satellite data to be used for detecting human infrastructure (such as small-scale mining) and targeted sampling of high resolution satellite data for selected sites. Specific JCN /45/ criteria are that "unless a larger or smaller area or greenhouse gas emission impact can be documented through remote sensing or field observations, the area within a distance extending 500 meters from the new infrastructure (including mining sites, roads, pipelines, reservoirs) shall be accounted with a 50% annual carbon loss through forest degradation." RP has conducted such remote sensing and field observations and has found that degradation never extended beyond 40m from the deforestation area. This conclusion is being backed by a pilot study by Applied Geosolutions LLC, c.f. Appendix 7 of IMR report /1/.

c   Validation of methodology against criteria

The new methodology applied by the RP to manually map degradation using high-resolution images within a buffer of 100m from the outside edge is deemed realistic by DNV because it was backed by both a desktop study of RapidEye images and a field study, as required in the JCN /45/. The verification team has checked the findings of the RP by visually inspecting

RapidEye imagery over one of the mining hotspot areas and by revisiting 5 of the 24 transects and repeating the degradation measurements.

The verification team concludes that the analysis methodology used by the RP meets provisions of the JCN /45/ and the 100m buffer is empirically more realistic than the 500 m buffer suggested in the JCN /45/.

Accuracy assessment

Additionally, the verification team checked the final results of the independent accuracy assessment performed by the University of Durham /16/ and provided by the RP. According to this assessment the overall accuracy of the Year 2 degradation mapping would be equal to 97.08%, which would confirm the acceptable accuracy of the mapping according to the REDD sourcebook /46/ and to other applicable criteria /55//56/. 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 the excel sheets used to calculate the final accuracy values.

4.3.2 Verification of Indicator

The verification team used existing input GIS data from the RP, selected and buffered required new infrastructure to 500 meters, and followed the validated methodology in order to check that the result was consistent with the RP's assertion. The verification team has visually inspected several parts of the RapidEye imagery and revisited and re-measured 5 of the 24 transects that were used to develop the Year 2 method. As a result the verification team concludes that the Year 2 method of mapping degradation is correct.

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.

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

As a result, the verification team concludes that the Year 2 method conforms to the JCN and probably gives a more accurate figure than the method used in Year 1, The verification team achieved the same results as the RP, and concludes that the value for indicator 2b for Year 2 is equal to 5 460 ha.

4.4 Interim indicator 3 - Verification of Forest Management

4.4.1 Methodology validation

a Methodology description

The RP has in place a forest monitoring system which has enforcement of forest legality amongst its main objectives /10/. The monitoring system has four main components in place:

- 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 /10/. 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/10/;

- Sawmills and Lumberyards monitoring: This component consists of the verification of the legality of sawmills and Lumberyards and their operation /21/

- Exports: This component of the monitoring system seeks to control all exportations and to check the legality of the produce to be exported /22/.

As in Year 1, all data used to calculate the Interim Indicator 3 for Year 2 is sourced from the monitoring of the forest product in transit component. and the verification has therefore concentrated on this.

The existing CoC system is based on the traceability through the use of tags with a unique identification code on each unit of produce (i.e. log) /17/. The CoC system starts by the on-stand tagging of the forest produce (i.e. logs, lumber piles, poles and posts); once a tree is felled, the stump and the bole are tagged with the same sequence of numbers. This tag number provides a reference for the name of the operator and the geographic origin of the forest produce within the forest estate. This is required for any forest operation regardless of whether it is located in State Forest lands, Amerindian lands or private properties /17/.

The link between the tagging system and the produce information (e.g. origin, destination, volume, type of produce) is done through the volume declarations included in the removal permits.

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 has written procedures which are now in place, as DNV was able to confirm.

State Forest lands

The monitoring process for extracted volume from State Forest Lands remains the same as reported in Year 1 verification /63/. The operator has to request for the issuance of a removal permit in any of the existing forest stations /17/ (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 /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 relevant information /17/. As part of the QA/QC measures in place, the produce transported and the correctness of the removal permit are checked by one or various GFC strategically located check-points. This check is recorded in books stating the removal permit license, the type of produce, volumes and date of 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 /17/. 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.).
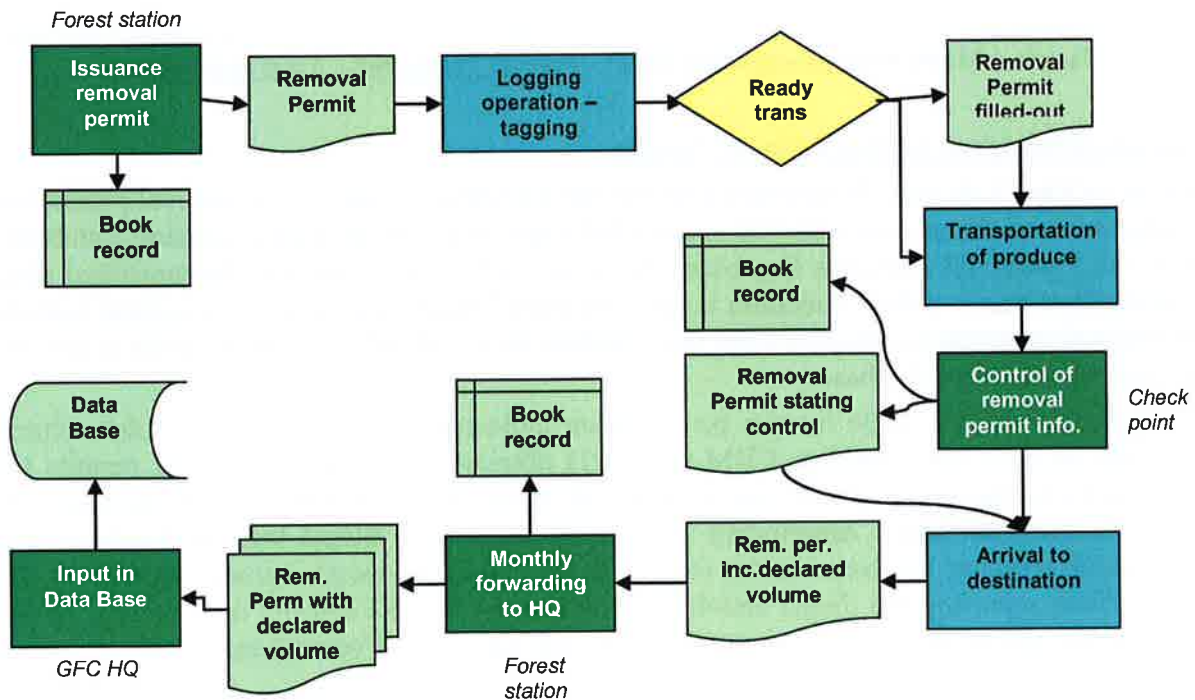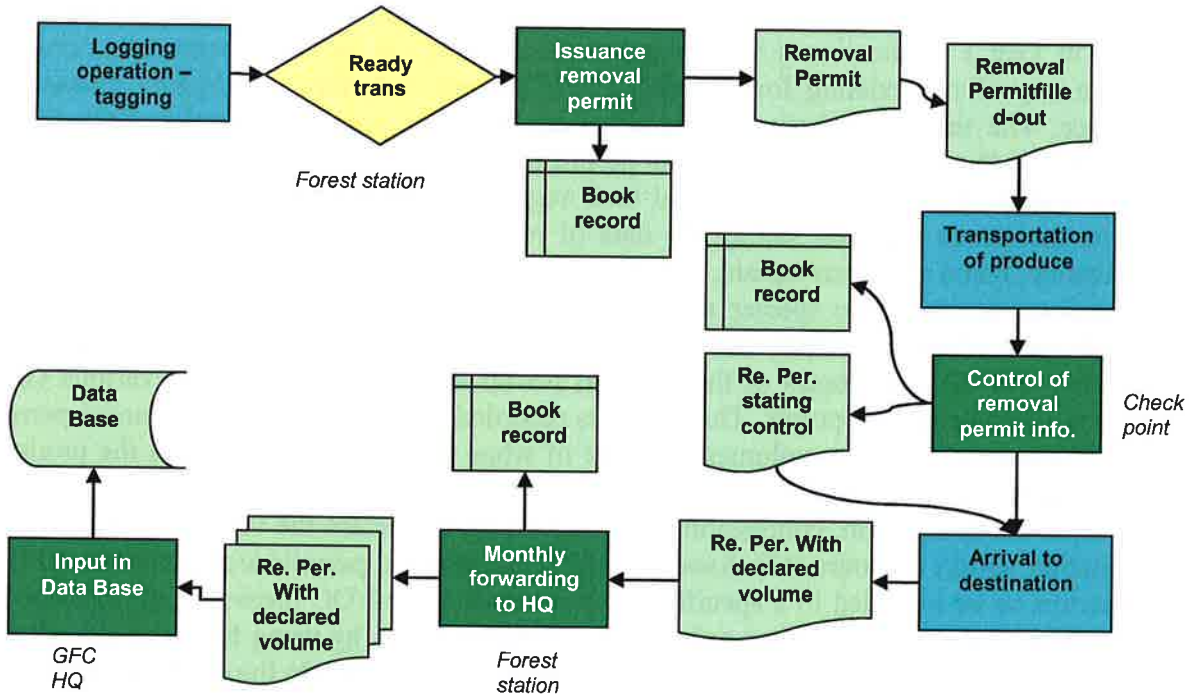

Figure 3. Monitoring process flow chart – State Forest Lands

Private Properties / Amerindian lands:

As in Year 1, the owner is not required to request a removal permit before the logging commences, however they are required to have a removal permit filled-out once the produce is to be transported outside the regular 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 - <u>Private Properties / Amerindian lands</u>

<u>Procedural breach or an illegal logging breach</u>

Just as in Year 1, in case the operator does not have a removal permit or a removal permit has inconsistencies, the amount removed is recorded respectively in the Illegal Logging Databases or in the Procedural Breaches Database /28/. Also, only in the case it is demonstrated after investigation that a certain operation is not considered legal logging or a procedural breach, the respective record is cancelled from this database and is added to the State Forest or private property/Amerindian databases.

The reported results of the interim performance indicator for Year 2 are the total volume extracted in tCO_2 (expressed as CBM in Year1) 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.

b   Validation criteria and Indicators

According to the Joint Concept Note (JCN) on REDD+ cooperation between Guyana and Norway/45/ 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, a default expansion factor (to be established)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 is collected by the Forestry Commission. Independent forest monitoring will contribute to verify the figures"* /45/.

In line with the findings during the first verification /57/ 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 shall 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 Year 1. This involves verification of each operation of the monitoring process: the data collection, QA/QC procedures for data collection, intermediate data recording, and data recording in the main data base, QA/QC procedures for data recording, reporting and QA/QC procedures for data reporting. For each of these operations, the verification team checked the training of personnel/30//31//34//37/ via interviews, which checked the GFC staff's knowledge of the procedures in place. Furthermore, the verification team performed spot checks of removal permits in order to verify the consistency of the information of each database, with the information in the removal permit (or illegal logging forms) and with the records available at the forest stations (Mabura forest stations were audited) /31//41//42//43//44/.

The RP 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 was well trained and during the audit showed great level of involvement and dedication to not only implementing the procedures but also seeking changes to them when this would lead to an overall improvement of the system. Since the last audit the RP has introduced a number of new procedures specifically focused on sampling, the collection of data on damage, biomass, and emission factors /10//11//12//13//15/. Some of the procedures were not yet completed and others were subject to revision. However, the work that has been put into the procedures and the implementation provide a good indication on the level of commitment that the audit team found within the GFC and its staff to provide quality work and data.

The preliminary data that has come out of the work that the GFC and Winrock has done show a high level of consistency and predictability on the level of damage and impacts per cubic meter harvested. However, at the time of the audit additional data were being processed by Winrock and GFC for full reporting on emissions factors. It is anticipated that during Year 3, GFC will be able to an even more comprehensive calculation module for Guyana that links extracted volume with associated damages.

The verification team concludes that the analysis methodology used by the RP meets provisions of the JCN /45/.

4.4.2 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: Hard copy records and books located in Mabura forest stations were cross-checked against database records.

In 2011, RP 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 reports by Winrock International (S. Brown *et al.*) for the GFC: *Collateral Damage and Wood Products from Logging Practices in Guyana, December 2011* and *Carbon Impacts of Land Use and land Use Change in Guyana: Emission Factors and their Uncertainties (Draft))*. The methodology applies the logging damage factor (0.98 tC/m^3), wood density of commercially harvested timber (0.38 tC/m^3), logging infrastructure factor (skid trails, etc.) (34.1 tC/km) and the conversion factor for tC to tCO_2 in the conversion of total volume in CBMs to tCO_2, and also includes storage in long term wood products. 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- *REDD Methodology Module: "Estimation of carbon stocks in the long-term wood products pool"* which DNV cross-checked and confirmed. This computation was based on all extracted wood biomass (including exports) captured by GFC's with the data available of wood harvested for Year 1. DNV 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 IMR and the VCS Module VMD0005.

The verification team did not detect any discrepancy that the reported assertions on Interim indicator 3 - Forest Management is equal to 3 685 376 tCO_2.

4.5 Interim indicator 4 - Emissions resulting from illegal logging activities

4.5.1 Methodology validation

a   Methodology description

The monitoring of illegal logging is within the main objectives of the forest monitoring system described in section 4.4.1.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) /45/ 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: "*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*".

c   Validation of methodology against criteria

The verification team concluded that the analysis methodology used by the RP meets the requirements of JCN /45/, and if applied correctly it will lead to assertions with minimum material discrepancies.

4.5.2 Verification of Indicator

In order to verify the reported assertions of Indicator 4 in Year 2, 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 in the Mabura station were checked with the database records;

The estimated emissions from illegal logging rate for Year 2 is equal to 18 289 tCO$_2$.

4.6 Interim indicator 5 - Emissions resulting from anthropogenically caused forest fires

4.6.1 Methodology validation

In accordance with the JCN /45/, a study of burned areas leading solely to forest degradation, was carried out by the RP by visually assessing least cloud Landsat 4, 5, and 7 satellite images using all available sensor channels and suitable band combinations were used as a back-up when no (cloud free) RapidEye image was available. MODIS FIRMS (Fires Information Resource Management System) hotspot data were used as additional reference dataset.

Input data used for the calculation of emissions from anthropogenically caused forest fires in Guyana are consistent with the Greek Risk-EOS case described in the GOFC-GOLD REDD sourcebook /46/ with that a comprehensive burned area overview has been created using the entire period of Landsat data. This is consistent with post fire assessment activities in both USA and Portugal as described in the REDD sourcebook /46/. Efforts to identify burned locations were improved using MODIS-based hotspot data from the Fire Information for Resource Management System (FIRMS) for the period of 2000-2010 (NASA/University of Maryland, 2002). Although similar data could have been acquired from the Advanced Very High Resolution Radiometer (AVHRR) or geostationary operational environmental satellites (GOES) from a number of sources for the years 1990-1999 /46/, none were available for this effort.

4.6.2 Verification of Indicator

A consistency check was performed in order to verify that the reported assertions were consistent with the results obtained through the application of the validated methodology. An analysis of the area burned was made using the same Landsat and RapidEye data used and made available by the RP.

According to the reported assertions, the total burned area in the analysis period was 28 ha/year. This total is considerably lower than initially estimated total of 1 706 ha/year /1//57/. Although Guyana has, during this monitoring period, seen a higher total number of ha affected by burning most if not all observed fires occurred in non-forested & savanna areas.

The verification team confirmed that the figure of 28 ha/year is consistent with the verification result.

5   COMMENTS BY STAKEHOLDERS TO REPORT

The Interim Measures Report was published for public comments from 15 June, 2012 to 6 July, 2012 in Guyana Forestry Commission's web page as well as distributed to a list of 66 individual stakeholders of 37 different stakeholder organisations. Comments received during this period are given in the below text box. Response from the RP to these comments and the verification team's assessment are included.

A request from the Government of Norway was made to GFC to allow additional comments after the official commenting period closed, which was agreed by GFC. All additional comments which were received 9 July 2012 have been included and responded to by GFC and can all be found in section 5.1 of this report.

Table 1: list of Stakeholders consulted by the Guyana Forestry Commission

	Name	Agency Role		Name	Agency Role
1	His Excellency President Donald Ramotar	Government of Guyana, Office of the President	34	Edward Shields	Guyana Gold and Diamond Miners Association (GGDMA)
2	Former President Dr.BharratJagdeo	Government of Guyana	35	Gillian Burton	Trade Unions Congress (TUC)
3	Dr Roger Luncheon	Office of the President	36	Paulette Bynoe	University of Guyana (UG)
4	Minister Dr Ashni Singh	Ministry of Finance	37	David Singh	Conservation International (CI)
5	Minister Robert Persaud	Ministry of Natural Resources and Environment	38	Jocelyn Dow	Independent Member of Civil Society
6	Minister Dr. Leslie Ramsammy	Ministry of Agriculture	39	Joe Singh	Individual Capacity
7	Minister Pauline Sukhai	Ministry of Amerindian Affairs	40	David James	Individual Capacity
8	ShyamNokta	Office of the President	41	AdreasTveteraas	Government of Norway
9	Andrew Bishop	Office of the President	42	Maarten van der Eynden	Government of Norway
10	Steven Grin	Office of the President	43	Sigrid Brynestad	DNV
11	Shereeda Yusuf	Office of the President	44	Herold Martin	GOFC-GOLD
12	James Singh	Guyana Forestry Commission	45	Sandra Brown	Winrock International
13	Pradeepa Bholanath	Guyana Forestry Commission	46	Nancy Harris	Winrock International
14	IndarjitRamdass	Environmental Protection Agency	47	Silvia Petrova	Winrock International
15	George Jarvis	Ministry of Agriculture	48	Felipe Casarim	Winrock International
16	PeterPersaud	The Amerindian Action Movement of Guyana (TAAMOG)	49	Katherine Goslee	Winrock International
17	Jean La Rose	Amerindian People's Association (APA)	50	William Salas	Applied Geosolutions
18	Romel Simon	The National Amerindian Development Foundation (NADF)	51	Bobby Braswell	Applied Geosolutions
19	Alfred King	Ministry of Culture	52	Dr James Baker	Clinton Climate Initiative
20	Sydney Allicock	North Rupununi Development Board	53	Dr ErkkiTomppo	REDD+, Forestry Specialist

	Name	Agency Role		Name	Agency Role
		(NRDDB)			
21	HilbertusCort	Forest Producers Association (FPA)	54	Maria Sanz	IPCC Expert
22	Ramesh Dookhoo	Private Sector Commission (PSC)	55	Dr Jim Penman	IPCC Expert
23	Carvil Duncan	Federation of Independent Trade Unions of Guyana (FITUG)	56	Dane Gobin	Iwokrama
24	Hymawattie Lagan	Women's Affairs Bureau	57	Dr Raquel Thomas	Iwokrama
25	Patrick Williams	World Wildlife Fund (WWF)	58	Sharon Austin	Ministry of Amerindian Affairs
26	Vanda Radzik	Independent Member of cicil Society	59	NaseemNasir	Guyana Lands & Surveys Commission
27	Karen Livan	Guyana Geology and Mines Commission (GGMC)	60	Donald Singh	Guyana Geology & Mines Commission
28	Yvonne Pearson	National Toshaos Council (NTC)	61	Colin Sparman	Guyana Gold & Diamond Miners Association
29	PemelaMendonca	The Amerindian Action Movement of Guyana (TAAMOG)	62	Lawrence Lewis	University of Guyana
30	Ashton Simon	The National Amerindian Development Foundation (NADF)	63	Krishna Basdeo	Forest Producers Association
31	Colin Klautky	Guyana Organisation of Indigenous People (GOIP)	64	Neil Chand	Forest Producers Association
32	George Norton	Guyana Organisation of Indigenous People (GOIP)	65	Geeta Singh	Environmental Protection Agency
33	Bertie Xavier	North Rupununi Development Board (NRDDB)	66	PreeyaRampersaud	Conservation International (CI)

5.1   Received comments and response by the Guyana Forestry Commission

Comment by: Norwegian Ministry of the Environment

☐ NGO   ☒ Party   ☐ Other Stakeholders

Sent on: 06 July 2012

Subject: Comments on GFC/Indufor report

Comment 1:

Please allow us to take this opportunity to thank you for receiving our comments on this report. Guyana has made impressive progress in developing the MRVS, as well as in taking action in order to keep deforestation and forest degradation at levels low. If the results of this report are confirmed, forest based emissions in Guyana seem to have stabilized at an impressively low level. We thank you again for your cooperation, and wish you the best of luck in the continuation of your work.

Response GFC:

> *Guyana also sees the progressive improvements in the work on forest area assessment, as part of the MRVS roadmap process.*
>
> *We plan to further work on some existing areas, such as degradation mapping, as well as to introduce new areas under the forest area assessment work in 2012/2013. A number of these have been summarised in Section 1.6 of IMR Version 1.*
>
> **DNV:** *The verification team assessed the comment and the response as well as the modification in the Preface p.4 of the report to be satisfactory*

Comment by: Norwegian Ministry of the Environment

☐ NGO ☒ Party ☐ Other Stakeholders

Sent on: 06 July 2012

Subject: Comments on GFC/Indufor report

Comment 2:

We see that the deforestation rate presented do not include 225 has of deforestation related to the Amaila Falls project. While it is indeed important to clarify how much deforestation is a consequence of the Amaila Falls project, we do believe that the indicator for gross deforestation should be presented as a total of deforestation. One option could be to present the total deforestation number, and state in the same paragraph that "this includes 225 hectares of deforestation rate related to the Amaila Falls project", or similar. Should the deforestation rate in a year fall above the agreed maximum level of deforestation, we think presenting a total number first, and then subtracting the Amaila Falls related deforestation, would be the clearest way of reporting. We do feel that this would best reflect the wording in the JCN, and that it would indeed represent "Gross deforestation" in the most correct way possible.

Response GFC:

The Indicator on Gross Deforestation has been adjusted to include the 225 ha associated with the Amaila Falls development. A notation is made to reflect this. This change increases the total area of deforestation

DNV: *The verification team assessed the comment and the response as well as the modification in the Section 8 p.86 and Table 8.2 on p 89 of the report to be satisfactory.*

Comment by: Norwegian Ministry of the Environment

☐ NGO ☒ Party ☐ Other Stakeholders

Sent on: 06 July 2012

Subject: Comments on GFC/Indufor report

Comment 3:

We note with great interest that data from several satellite sensors, as well as flight photos, have been used for the year 2 assessment. How has the interoperability between data sources been validated? Some more information on this could be added to the report.

Response GFC:

This is touched upon in section 7 of the IMR.

The primary datasets used in the change detection process include Landsat TM & ETM+ and RapidEye (over high activity areas). The mapping methods used are consistently applied and documented in the mapping guide (Appendix 9). All additional datasets are used to provide additional information to support the change detection decision. This is either to check areas covered by cloud (radar), or over-flights to confirm land cover types or change drivers.

A mapping improvement programme will be implemented in Year 3. Improvements will focus on updating existing base layers such as non-forest and historic pre-Year 2 forest change. These updates are designed to improve the spatial accuracy of the MRVS.

DNV: *The verification team assessed the comment and the response as well as the modification in the Section 4 p. 14 of the report to be satisfactory. During the audit additional attention was paid by the verification team to consider the different impacts the changes from Landsat to RapidEye images could have on the outcome of the reported emissions. It was found that GFC has put in place and proper system of technology and qualified staff which has assured a smooth transition as well as an overall increase in accuracy of data.*

Comment by: Norwegian Ministry of the Environment

☐ NGO   ☒ Party   ☐ Other Stakeholders

Sent on: 06 July 2012

Subject: Comments on GFC/Indufor report

Comment 4:

It seems a lot of the methodology is revised based on reports made by Winrock and Applied GeoSolutions. One related to collateral damage and wood products, and the other concerning the new method for estimation of degradation. Have these reports gone through a peer review process or similar to validate the methods used?

Response GFC:

The following reportsare available for verification by DNV:

- *Brown S, Collateral Damage and Wood Products from Logging Practices in Guyana, December 2011*

- *Salas, W. Hagen, S, et al. Winrock International and Applied GeoSolutions.A Pilot Study to Assess Forest Degradation Surrounding New Infrastructure. Guyana Forestry Commission. February, 2012.*

Yes, these reports were peer reviewed. Indufor and GFC both have reviewed these reports and provided feedback, which were used to update the reports. Also, field validation was carried out by Indufor on the Report on Forest Degradation. Additionally, these report used or evaluated peer-reviewed methods established and tested by remote sensing experts including Carlos Sousa.

Winrock International is part of the GFC/Indufor team for this year 2 of verification.

Further, the aspects of collateral damage and wood products were included in the Sample design document which was peer-reviewed.

DNV: *The verification team assessed the comment and the response as well as the modification in the Section 6.5 p.57 of the report to be satisfactory. During the audit special*

attention was paid by the audit team to examine the implementation of the new procedures and impacts that the revised methodology had on the outcome. It was found that the revisions were in line with the JCN and provide a more accurate assessment of the changes in the forests found in Guyana and subject to degradation.

Comment by: Norwegian Ministry of the Environment

☐ NGO   ☒ Party   ☐ Other Stakeholders

Sent on: 06 July 2012

Subject: Comments on GFC/Indufor report

Comment 5:

While the method should give a good estimation of degradation where clear breaches in the canopy can be observed from RapidEye imagery, we are concerned that significant biomass loss can take place without there being an observable breach in canopy. Supplementing information on how this is treated should be added.

Response GFC:

Based on the MRVS Roadmap, for the full MRVS, both forest area assessment and forest carbonstock assessment (and associated monitoring system), will be used, taking account of both deforestation and forest degradation drivers. This is not a requirement under the interim measures but under the full MRVS. As such the Forest Carbon Monitoring System being designed integrates this using the gain / loss method.

Forest harvest, which is the main driver that will lead to biomass loss, is being addressed under the forest carbon monitoring system with an emission factor already established for this (further calculations are provided below).

In the same way, degradation from mining, fire, infrastructure, and shifting agriculture (which are more likely to be detected from satellite imagery) are also being explored from field studies, and will have also emission factors established.

Further, in conducting the accuracy assessment, field checks of the degradation methods was completed. This is proposed to be a standard part of all annual reporting since it allow for a validation of the completeness of the degradation reporting.

This is covered in: Forest Carbon Monitoring System Design Document (Goslee, K., Brown, S., et al. Sampling Design and Implementation Plan for Guyana's REDD+ Forest Carbon Monitoring System (FCMS). Guyana Forestry Commission, September 2011.

What is considered significant biomass loss---the estimated total carbon stock of the forests based on the FCMS sampling design is 321 t C/ha (average of more and less accessible, excluding soil). One might argue a loss of 10% or more might be considered significant loss if that loss was sustained. Thus do degrading activities reduce the biomass by more than about 32 t C/ha? Which pools could be affected by agents of degradation in the buffer zone (these will include the people working in the mines and to a lesser degree by people associated with logging when satellite logging camps are established) that do not cause a breach in the canopy. First litter could be one of these pools (currently estimated to be about 5-6 t C/ha) and it is possible that this pool could be affected—however in its natural state in Guyana's forest this pool likely turns over about once a year , that is the litter decomposes,

emitting CO2, but then replaced by litterfall during the year. So even if this pool was disturbed there are not net emissions.

Understory herbaceous biomass is another potential pool to be affected. Based on field data from preliminary plots this was estimated to be <0.5 t C/ha and was considered insignificant and not included in final sampling plan—so we assume this pool can be ignored.

Sapling could be trampled and killed—the estimate of sapling biomass obtained from the field plots is 1.2 t C/ha—even though these could be killed, they will likely recover quickly given the growing conditions in the forest and the existing seed source. There is no use for dead wood by degrading agents so this pool would not be affected.

The only pool likely to be reduced and not show up as a breach in the canopy is the use of small diameter trees (5-15 cm range) by the degradation agents—trees in this size class are often cut to provide poles etc. for the people working in the mining and logging areas. We estimated the size of this pool from the field plots to be 22 t C/ha—however it is unlikely that the degrading agents would cut all these smaller size trees so that the actual impact is significantly lower than the 22 t C/ha.

So overall we argue that the biomass loss from degrading activities in the buffer zones that does not cause a breach in the canopy is insignificant.

Further evidence is also provided by analysis conducted by Winrock International which is based on the empirical data collected from;

- *biomass plots*
- *logging plots on collateral damage, gap area, volume per gap extracted*
- *the GFC Code of Practice timber extraction rates*
- *estimates of total emissions from logging for the period 2001 to 2010.*

These data are used to estimate the likely reduction in biomass (and thus C stocks) of Guyana's forests under different levels of extraction. Since logging is an operation of some scale it represents the upper limit of degradation. Logically degradation around mining and road infrastructure is not practiced at the same intensity.

We then estimated the reduction in biomass for extraction rates higher than the code of practice levels and also estimated how much timber would need to be extracted to reduce the biomass of the forests by 50%. The results are given in the following table and figure.

It is clear that to get a reduction of 50% as proposed in the JCN would involve a huge rate of timber extraction, and that such a level would be readily identifiable in the remote sensing imagery. As it is, identification of degradation in remote sensing imagery indicates relatively small changes compared to deforestation, thus the evidence presented here cannot support the 50% reduction indicator and instead is more like <8% or so.

*Table: Percent reduction in biomass and canopy as a function of different timber extraction rates.*

Volume extracted m3/ha	% biomass reduction	% canopy loss
8.3	5%	3%
13.0	6.1%	4.3%
25.0	11.8%	8.3%
50.0	23.6%	16.7%
108.0	50.0%	36.0%

Figure: Relation between timber extraction rate and percent change in above and below ground biomass. The GFC Code of Practice extraction rates are less than 20 m3/ha.
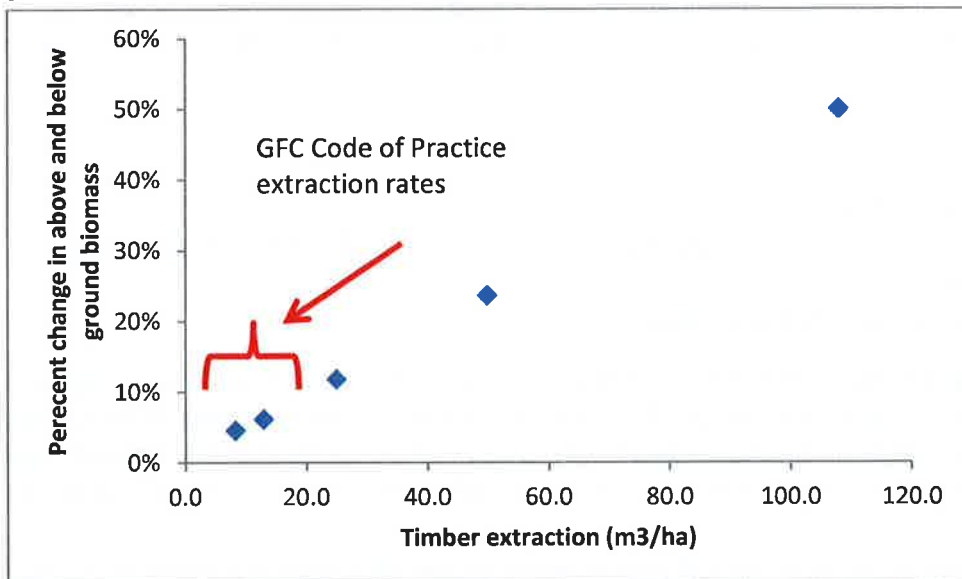
Source S. Brown - Winrock International 2012

DNV: *The verification team assessed the comment and the response as well as the modification in the Section 6.3 p.60 of the report to be satisfactory. During the audit the audit team examined in detail the process of damage assessment and the associated modelling and found that the process applied provided detailed information about the expected damage impact following logging activities that could not necessarily be observed through the RapidoEye images.*

Comment by: Norwegian Ministry of the Environment

☐ NGO   ☒ Party   ☐ Other Stakeholders

Sent on: 06 July 2012

Subject: Comments on GFC/Indufor report

Comment 6: Observable degradation is mapped around a 100 meter buffer around year 2 infrastructure. But what about degradation that happens in the vicinity of infrastructure from previous years? We believe that areas surrounding infrastructure should be mapped for degradation every year, as degradation is likely to not always take place in the same year the infrastructure is developed.

Response GFC: *Back dating of degradation for previous change periods (i.e. year 1) is more challenging given the scale, intensity and fragmented nature of forest degradation. Additionally these areas rapidly recover biomass and appear very similar on 30 m resolution images to surrounding intact forest. For these reasons the default 500 m buffer was applied to year 1 change to account for degradation in that period.*

We agree that degradation for subsequent periods should be mapped and as such the plan is to build on the second year by acquiring 5m resolution imagery for the year 3 assessment. This temporal coverage will allow degradation to be spatially tracked by identification of new areas associated with year 3 change. GFC is currently considering expanding the coverage of RapidEye to all forest areas (~18 million ha).

DNV: *The verification team assessed the comment and the response as well as the modification in the p.62 of the report to be satisfactory. This was covered during the assessment and part of the re-evaluation of the methodology considering the enhanced images now available to GFC.*

Comment by: Norwegian Ministry of the Environment

☐ NGO   ☒ Party   ☐ Other Stakeholders

Sent on: 06 July 2012

Subject: Comments on GFC/Indufor report

Comment 7: As a general comment; we think the approach to use RapidEye imagery to estimate degradation is very interesting. However, the studies conducted seem to be too few and conducted in too small of an area to justify application of the method to the national level. We would encourage to do more studies and to ensure sufficient samples to better validate the methods.

Response GFC:It should be noted that Winrock International and Applied Goesolutions study conducted developed a method that was proven to be sound, consistent and applicable to the practical circumstances relating to the drivers of forest degradation. The findings of this were based on matching empirically derived data to a range of satellite sensors and image processing techniques across degradation sites. The report concludes the following;

The fact that the radius of observable degradation seen in this analysis is limited to 100 metres is not surprising given that significant losses of trees in principle should only be associated with direct effects of installing new infrastructure. Indirect effects will be limited to subtle changes in forest structure and biogeochemistry that are likely caused by: (1) drying due to increased exposure; (2) altered turbulence and wind patterns; (3) invasion of gap species, out-competing low light species; and (4) temperature changes. All of these factors occur at close proximity to the gap edge and require actual penetration of altered light and moisture regimes into the canopy at distance. Indeed, many of these mechanisms could actually result in enhanced carbon storage (e.g. introduction of faster growing species in the buffer region). Therefore, viable mechanisms for removing carbon in the 10-50% range require large scale extraction of stems and crowns that we have demonstrated are visible in the remote sensing imagery. Furthermore, the signal of tree removal and associated gap formation is directly observable in satellite imagery due to the fundamentally different reflectance spectra associated with NPV and soil, versus green vegetation. While there are always uncertainties in image analysis associated with geo-location and atmospheric effects,

the underlying principles of this analysis are straightforward, and similar to many other analyses that have performed in other regions. There is nothing strictly location-specific about the methodology we used because it relies almost entirely on the simple notion that vegetation appears differently in the visible and near infrared regions than non-vegetation, and as we have also shown, this applies to imagery with resolutions ranging from 0.5 to 30-metres. While additional field work will assist in improving the precision of our results, especially the actual carbon impacts, we feel the general conclusions in this section should have broad applicability across similar vegetation types.

These methods were tested by Applied Geo Solutions which concluded that 40 m is the extent of forest degradation. These were then further tested by Indufor over 24 sites using remote sensing techniques. The results were verified over seven field sites to determine the applicability of the methodology developed and scrutinised further during the independent accuracy assessment.

The GFC/Indufor field measurements confirmed that degradation impact is localised to the immediate extent of the deforestation event (~40 m). Additionally the findings concur with Applied Geosolutions conclusions that there is nothing strictly location specific to the approach adopted.

A series of mapping rules were developed. These were designed to be conservative by evaluating 100 m buffer around each year 2 deforestation event. These rules were applied and evaluated during the accuracy assessment.

***DNV:** The verification team assessed the comment and the response as well as the modification in the p.62 of the report to be satisfactory. This was covered during the assessment and part of the re-evaluation of the methodology considering the enhanced images now available to GFC.*

Comment by: Norwegian Ministry of the Environment

☐ NGO ☒ Party ☐ Other Stakeholders

Sent on: 06 July 2012

Subject: Comments on GFC/Indufor report

Comment 8: The table on page 73 states no number for degradation in relation to agriculture. Have areas surrounding agricultural land been assessed for degradation?

Response GFC:For the current interim measures degradation is only reported for areas surrounding new infrastructure. New infrastructure includes (mining sites, roads, pipelines and reservoirs). Degraded areas reported for other change drivers such as forestry are related to degradation surrounding roads.*

Once operational the degradation methodology developed in Year 2 will be applied to map and monitor degradation surrounding forest change areas.

***DNV:** The verification team assessed the comment and the response as well as the modification in the Table 8.2 p.78 of the report to be satisfactory. During the audit special attention was given to the degradation methodology and its effectiveness.*

Comment by: Norwegian Ministry of the Environment

☐ NGO   ☒ Party   ☐ Other Stakeholders

Sent on: 06 July 2012

Subject: Comments on GFC/Indufor report

Comment 9: On page 59 it is stated that "An important consideration is a forested area is only deemed deforested once the cover falls and remains below the elected crown cover threshold (30% for Guyana). In Guyana's context, forest areas under SFM that adhere to the forest code of practice are not considered deforested as they have the ability to regain the elected crown cover threshold." Are these areas monitored to ensure that the crown cover is indeed regenerating?

Response GFC:The Interim Indicators do not require that a spatial representation of forest degradation over managed forest areas. This is required once the full MRVS becomes operational.

The Interim Measures require that forest degradation around new infrastructure be mapped. This has been done using 5 m resolution imagery for a large part of the forest area of Guyana (all of the allocated State Forest Estate) - as outlined in the report. It should be noted that if the area is in fact deforested then it is mapped in accordance with the mapping guidelines.

The Interim indictors instead speak to reporting on forest management and converting removed forest produce to carbon numbers. This was done.

As such, the Forest Carbon Monitoring System includes assessment of forest degradation with the Gain/ Loss Approach to be applied and uses empirical data (for collateral impacts, incidental damage and re growth). This is therefore accounted for under the MRVS.

We also point out that the typical timber extraction rate of about 8.3 m3/ha (set by GFC) has a very small impact on the forest canopy. Based on the logging plots measured as part of the FCMS (184 logging plots) we found that the harvested trees yielded an average of 3.4 m3 of extractable timber (3.4 m3/logging plot). The average gap area created by these felled trees is 33.3 m2/m3 extracted. Thus the total number of trees harvested per ha is about 2.3 (2-3). The harvesting of these trees creates a total gap area of about 276 m2 (0.028 ha). Thus the typical timber harvesting practices creates gaps representing about 3% of a hectare. Skid trails can also create gaps—based on data from the logging plots and from GFC on total timber harvesting and length of skid trails, we estimate that skid trails affect 280 m2/ha or potentially another 3% of the canopy. However, it is unlikely that the skid trails actually breach the canopy as they do not cause large trees to be felled.

In conclusion the harvest of trees using the code of practice affects no more than about 5-6% of the canopy of 1 ha.

As for the issue of regeneration—we have also collected preliminary data for estimating regrowth and regeneration after logging. We established plots in 69 recently logged gaps and 28 in logging gaps created three years ago—we used the same plot design in both occasions. We compared the carbon stocks of the two age classes and found regeneration and regrowth rates of about 5 t C/ha per year—a very healthy rate of recovery.

The Interim Measures require for forest degradation new infrastructure to be mapped and this is done by remote sensing in year 2 for the reasons outlined in the report, one of which is the fact that in this year, 5m resolution imagery was acquired for a large part of the forest area of Guyana (all of the allocated Sate Forest Estate).

Additionally wall to wall mapping is done of all areas so the coverage is national and complete/comprehensive.

DNV: The verification team assessed the comment and the response as well as the modification in p65 of the report to be satisfactory.

Comment by: Norwegian Ministry of the Environment

☐ NGO ☒ Party ☐ Other Stakeholders

Sent on: 06 July 2012

Subject: Comments on GFC/Indufor report

Comment 10: In the report "Collateral Damage and Wood Products from Logging Practices in Guyana" from 2011, it is stated that "It does not take into account imports and exports of wood that are addressed in IPCC Greenhouse Gas Inventory methods as decision on how to track emissions' from wood products that are imported and exported are still pending in the international arena." However, in the new LULUFC-decision from Durban it is stated that imported wood products are not to be included. As this implies that counties importing wood products from Guyana will not include these emissions, are you planning to revise the relevant calculations accordingly?

Response GFC: The factor used in the Interim Measures Report year 2 includes exports and computations regarding carbon storage and Long Term Wood Products.

Therefore formula in Winjum et al. 1998 was used with VCS approved methodology for wood products –6CP-W Wood Products November 2010).

Additionally, collateral damage includes all aspects of emissions associated with wood extracted.

We agree with your comment re decision regarding imports and exports and have removed that sentence from the report. The application of the collateral damage factors are applied to all production of timber from Guyana.

Although a decision regarding imports have been made under the LULUCF, how this issue will be applied to REDD+ carbon accounting has not been decided upon. We would like to point out that the logs are not a wood product per se but rather a raw material that could be exported and imported to developed countries--one might argue that this should be treated like oil.

The factor used in the Interim Measures Report year 2 includes exports and computations regarding carbon storage and Long Term Wood Products.

DNV: The verification team assessed the comment and the response as well as the modification on p 115 of the report to be satisfactory.

Comment by: Norwegian Ministry of the Environment

☐ NGO ☒ Party ☐ Other Stakeholders

Sent on: 06 July 2012

Subject: Comments on GFC/Indufor report

Comment 11: The basis for the reduction of IFL-area is somewhat unclear to us. It seems it has been reduced to reflect "anticipated future mining activities". Does this reflect areas for future possible exploration, or does it reflect already given and legally binding concessions? I.e. does it reflect anticipated mining activities, or confirmed mining activities? In general, we believe that areas that are not under legally binding concessions are better included in the IFL-area, whereas areas with confirmed future activities could probably justify exclusion.

Response GFC:The areas for reconnaissance will be subject to future mining allocation. The first step in this process is the allocation of these areas to a reconnaissance status.

These areas are therefore been excluded. Given that national wall-to-wall mapping has been implemented using high resolution satellite images GFC would prefer that this interim measure is phased out in Year 3. This is in keeping with the JCN desire to replace interim measures once methods become operational.

The rationale for this request is that spatial tracking of change from high resolution (5 m) satellite images at the national level provides an accurate and transparent method of calculating national forest change.

In contrast the current IFL extent is quite broad as it is delineated from medium resolution imagery (30m) after applying a predefined set of criteria. Effectively the IFL has been superseded by high resolution wall-to-wall mapping.

DNV: The verification team assessed the comment and the response as well as the modification on p 109 of the report to be satisfactory. This assessment team paid special attention to this comment when assessing the changes that were made as part of the introduction of the Rapideye images to replace the Landsat images

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Comment by: Norwegian Ministry of the Environment

☐ NGO   ☒ Party   ☐ Other Stakeholders

Sent on: 06 July 2012

Subject: Comments on GFC/Indufor report

Comment 12: On page 86 it is stated that "Background sources such as shifting cultivation and historical and current areas under sustainable forest management have been included as IFL." Even though logging related to SFM might occur with low intensity in Guyana, we do believe that areas subject to industrial logging of any scale should be excluded from the IFL-area. The JCN also includes "Areas used for agriculture and timber production;" in the elimination criteria for IFL.

Response GFC:Agreed. These areas have actually been excluded from IFL. Our initial statement refers to the fact that they were taken into consideration in IFL. Map 10-1 actually shows all allocated State Forest Estate excluded from IFL.

We will make this clarification in the revised Version 1 of the report – the statement can be found on page 86.

Please note that the computations remain the same, only the statement on page 86 requires changing.

DNV: The verification team assessed the comment and the response as well as the modification on p 86 of the report to be satisfactory.

Comment by: Norwegian Ministry of the Environment

☐ NGO   ☒ Party   ☐ Other Stakeholders

Sent on: 09 July 2012

Subject: Comments on GFC/Indufor report

Comment 13: p.10: The sampling design would be better characterized as two-stage cluster sampling in which the clusters are stratified. The primary sampling units (PSU) or clusters are the 10km x 10km grid cells, and the secondary sampling units (SSUs) are the 1ha plots. The first-stage sample is a stratified random sample of clusters, and the second-stage sample is a systematic sample (of 361 plots) within each selected first-stage cluster. Although it is not a universally applied definition, two "phase" usually refers to a design in which the same size sampling unit is present at both "phases", whereas two "stage" sampling usually has different size sampling units at the two "stages" (e.g., PSU=10km x 10km cell, SSU=1ha plot).

Response GFC:We accept that the terminology is confusing; two-phase sampling or double sampling is a procedure where two samples are taken from the population to assess the association between the attributes of the two samples. Using the term two-stage more precisely describes the approach taken in this case that is a stratified two phase design.

Note however, that the sampling could be described as two-stage sampling with stratification of the primary units. In this case the GIS data are used to define the high and low risk zones as first-stage units and within each first-stage unit there we may sample one or more second-stage units. Second-stage units would typically be conventional forest inventory ground plots. In our case these are the 10 km by 10km grid cells: each of these sampling units is systematically assess for deforestation / degradation status using 1ha "plots" as a convenient unit for interpretation purposes.

In summary, the method used is clear and using the terminology of Kohl, Magnussen and Marchetti (2006) we accept that "two-stage sampling with stratification of the primary units" is a better term.

DNV: The verification team assessed the comment and the response as well as the modification in Appendix 10 p. 10 of the report to be satisfactory.

Comment by: Norwegian Ministry of the Environment

☐ NGO   ☒ Party   ☐ Other Stakeholders

Sent on: 09 July 2012

Subject: Comments on GFC/Indufor report

Comment 14: Table 12-7, p.19: The forest/non-forest error matrix should include the proper weighting to account for the stratified sampling design. The authors note that the estimation formulas must be appropriate for the stratified design (p. 11) and they specifically state that Table 12-7 does not incorporate the proper stratified formulas. The text suggests that the weighted (stratified) analysis is not necessary because the intent is only to note the correspondence between the map and reference data. The problem is that this "correspondence" is misleading if the proper stratified estimates are not used because the

sample counts in the error matrix do not represent the actual area proportions (for each cell) for the region.

Response GFC*:We deliberately presented that raw data for each stratum to illustrate precisely where misclassifications occur. This is particularly important for the interpretation of forest degradation areas because the number of degraded areas identified in the sample is small.*

We were careful to point out that the "correspondence" statistic was not weighted. A new table has now been added Table 3 10 with weighted values against the area percentage that each stratum occupies in the total Guyana area.

DNV: *The verification team assessed the comment and the response as well as the modification in the Appendix 10 p. 27 of the report to be satisfactory.*

Comment by: Norwegian Ministry of the Environment

☐ NGO ☒ Party ☐ Other Stakeholders

Sent on: 09 July 2012

Subject: Comments on GFC/Indufor report

Comment 15: p.21, Tables 12-8 and 12-11: It is not clear whether the information reported in these tables is based on the sample or some other source. If based on the accuracy assessment sample, are the estimates based on the proper stratified formulas? The text suggests possibly not: "We have not scaled the number of Road-deforestation sample points…"

Response GFC: *The data in the tables are correct. The sentence "We have not scaled the number of Road-deforestation sample points" refers to the fact that roads or other linear infrastructure bisecting or touching a 1 ha sampling unit automatically classify that unit as deforested (using our rules) even though when whole area of the sampling unit is not necessarily affected. We have made no attempt to "scale" for this and so it may be that deforestation from roads is slightly overestimated.*

DNV: *The verification team assessed the comment and the response as well as the modification in the Appendix 10 p. 21 of the report to be satisfactory.*

Comment by: Norwegian Ministry of the Environment

☐ NGO ☒ Party ☐ Other Stakeholders

Sent on: 09 July 2012

Subject: Comments on GFC/Indufor report

Comment 16: p.22, Table 12-9: The row total for Year 2 degradation should be 26 and the row total for Non Year 2 degradation should be 374, not 98. Once again the proper stratified estimates should be reported as, similar to Table 12-7, the results appear to be based on just the sample counts and the estimates are not weighted appropriately. The total sample size is 13,773, which is nearly 3,000 fewer sample points than shown for the Table 12-7 results for which the sample size is 16,765. We were not able to identify the reason for the discrepancy of 3,000 points.

Response GFC:Thank you for pointing out the offset in certain totals two of our tables. These data were not transcribed properly by the overall counts and statistics are correct.

The apparent discrepancy of 3000 points in Table 3 4arises because in the analysis one does not check for forest degradation when the land cover is non-forest and so this accounts for a difference of 2888 points.

DNV: The verification team assessed the comment and the response as well as the modification in the Appendix 10 p. 22 of the report to be satisfactory.

Comment by: Norwegian Ministry of the Environment

☐ NGO   ☒ Party   ☐ Other Stakeholders

Sent on: 09 July 2012

Subject: Comments on GFC/Indufor report

Comment 17: p.23 (Section 15.2): Unless there is a "gold standard" of truth for the ground condition, it is not possible to conclude that "there is no interpreter bias". Even if interpreters agree, it is possible they are assigning the wrong class label and because the interpreters are only being compared to each other and not to a gold standard, no claim of interpreter bias (or lack thereof) is possible. A discussion on how this might affect the overall uncertainty could be added. What could be done in the future, is to choose some of the 10x10 km blocks randomly, and thereafter some of the points within these blocks for field control. This could provide an estimate of the interpretation errors, and these could be included in the overall estimation of change and its associated variance.

Response GFC It is difficult if not impossible to have an absolute ground truth in this type of map accuracy assessment work. It would be nice to have a random sample of field validated control plots but GOFC-GOLD recognises that this is normally impractical, hence the methodology of using high resolution remote sensing as a proxy.

In this analysis we chose random samples to evaluate interpreter bias and these were sites where we ordered very high resolution imagery and we flew over at low altitude acquiring good quality oblique aerial photography. The process then involved training the team of interpreters and also checking their results. The reviewers are correct to suggest that our statement that there is "no interpreter bias" is too strong.

We removed the text "no interpreter bias" in p.23 and replaced it with more appropriate wording.

DNV: The verification team assessed the comment and the response as well as the modification in the Appendix 10 p. 23 of the report to be satisfactory. The assessment team paid special attention to this comment whilst assessing the introduction of the Rapid Eye imagery to replace the Landsat and the required changes in the method of operating based on a higher level of image information and the need for ground trothing.

Comment by: Norwegian Ministry of the Environment

☐ NGO   ☒ Party   ☐ Other Stakeholders

Sent on: 09 July 2012

Subject: Comments on GFC/Indufor report

Comment 18: Based on Table 12-12 (p.25), the area of deforestation estimated by the GFC and the area estimated by Durham can be compared to provide a non-site-specific estimate of accuracy of GFC deforestation (difference of 403 ha). However, is it fair to state that a spatially explicit assessment of the accuracy of deforestation is not available? That is, the data are not available to assess if the locations mapped as deforestation are in fact deforested and it is not possible to construct an error matrix of the form of Table 12-9 for deforestation?

Response GFC:A map is produced that shows the spatial distribution / pattern of errors. The overall estimations are, of course non-spatial

DNV: The verification team assessed the comment and the response as well as the modification in the Appendix 10 p. 25 of the report to be satisfactory.

Comment by: Norwegian Ministry of the Environment

☐ NGO   ☒ Party   ☐ Other Stakeholders

Sent on: 09 July 2012

Subject: Comments on GFC/Indufor report

Comment 19: p.25: Formulas for estimating variance for the design implemented need to be provided. The variance shown on p.25 is appropriate for simple random sampling, but it would not be appropriate for a two-stage cluster sample, the design implemented for this assessment. The variance estimation formulas provided by McRoberts for the model-assisted difference estimator apply to simple random sampling and (as an approximation) to systematic sampling, but not to cluster sampling.

Response GFC:"if the secondary units are drawn systematically from within the primary units, the design is not a true two-stage cluster sampling. In effect, the appropriate estimators to use in this case would be those given for single-stage cluster sampling" Kohl, Magnussen and Marchetti (2006). In this case the formulas applied are for the model-assisted difference estimatorare relevant to single stage sampling because each 10km by 10km square was assessed systematically by a regular sampling grid.

DNV: The verification team assessed the comment and the response as well as the modification in the Appendix 10 p. 25 of the report to be satisfactory. Special attention was paid during the assessment of the methodologies and the sampling techniques applied by GFC.

Comment by: Norwegian Ministry of the Environment

☐ NGO   ☒ Party   ☐ Other Stakeholders

Sent on: 09 July 2012

Subject: Comments on GFC/Indufor report

Comment 20: Tables 12-13 and 12-14 contain several errors. In Table 12-13, producer's accuracy of forest is 7070/7308 or 96.74%, and producer's accuracy of non-forest is 88.4%. A similar accidental shift occurs in Table 12-14, where producer's accuracy of forest is 99.28% and producer's accuracy of non-forest is 92.46%.

Response GFC:Yes thank you for pointing this out. This was a transcription error that is now fixed.

> **DNV:** *The verification team assessed the comment and the response as well as the modification in the Appendix 10 p. 20 of the report to be satisfactory.*

Comment by: Norwegian Ministry of the Environment

☐ NGO   ☒ Party   ☐ Other Stakeholders

Sent on: 09 July 2012

Subject: Comments on GFC/Indufor report

Comment 21: For full reporting of the accuracy of the Year 2 map of forest/non-forest, it would be helpful to provide an error matrix for the combined strata (low and high risk) and the estimates of user's, producer's, and overall accuracy along with the standard errors of these accuracy estimates. This error matrix would summarize results for the entire country.

Response GFC:A weighted overall error matrix has been created with all details included.

DNV: *The verification team assessed the comment and the response as well as the modification in the Appendix 10 p. 27 of the report to be satisfactory.*

Comment by: Norwegian Ministry of the Environment

☐ NGO   ☒ Party   ☐ Other Stakeholders

Sent on: 09 July 2012

Subject: Comments on GFC/Indufor report

Comment 22: p.34: The text states that 14% of the sample could not be used but p.19 has a statement (and data) indicating that 7% of the sample could not be used. Why are two different percents reported?

Response GFC:the 7% is now changed to the correct figure 14%

DNV: *The verification team assessed the comment and the response as well as the modification on p89 of the main report and in Appendix 10 p. 19 and 35 of the report to be satisfactory.*

Comment by: Norwegian Ministry of the Environment

☐ NGO   ☒ Party   ☐ Other Stakeholders

Sent on: 09 July 2012

Subject: Comments on GFC/Indufor report

Comment 23: p.35: The grid squares are 10km x 10km or 100km^2, not 10km^2 as stated on p.35.

Response GFC:the "10 km2" is now changed to "10x10 km2".

DNV: *The verification team assessed the comment and the response as well as the modification on p.35 of the report to be satisfactory.*

Comment by: Norwegian Ministry of the Environment

☐ NGO	☒ Party	☐ Other Stakeholders

Sent on: 09 July 2012

Subject: Comments on GFC/Indufor report

Comment 24: p.35: Recommendation #4 seems particularly relevant. If the sample size was not sufficient in 2012, what can be done to improve the situation?

Response GFC:This needs further discussion as time is needed to assess a suitably large sample size, particularly to evaluate degradation.

DNV: The verification team assessed the comment and the response as well as the modification on p. 35 of the report to be satisfactory.

Comment by: Rainforest Foundation, Norway ☒ NGO ☐ Party ☐ Other Stakeholders

Sent on: 06 July 2012

Subject: Comments on GFC/Indufor report

Comment 25: Under 10.4, (Degradation indicator 7-measure 2), there are two problems with the interpretation of the definition of IFL, which lead to an incorrect calculation of the total IFL area in Guyana.

Inclusion of industrial-scale, selective logging operations in IFL

The GFC/Indufor report includes active timber production areas within the IFL area, based on an erroneous interpretation of the IFL definition. This is surprising, given that the same mistake was made in the GFC/Poyry report on year 1, and that the independent DNV audit report pointed it out. The DNV report included a Corrective Action Request (CAR 5) to exclude timber production areas from the IFL map, on the basis that they are "not in line with the definition of IFL as it is logging at an industrial scale; at low intensity though." GFC formally accepted the suggestion from DNV.

The GFC/Indufor report states on page 86 that "industrial-scale exploitation of timber (clear felling with no natural regeneration), peat extraction and oil exploration are not practiced in Guyana in the period under review. (...) Background sources such as shifting cultivation and historical and current areas under sustainable forest management have been included as IFL."

However, the IFL definition that appears in the JCN and which is cited under 10.3 in the GFC/Indufor report, explicitly excludes "industrial activities such as logging". The GFC report errs in equating "industrial logging" with "clear-felling with no natural regeneration", an assumption without basis in the definition of and literature on IFL. Logging doesn't have to be clear-felling to be industrial-scale.

GFC's argument for including "areas under sustainable forest management (SFM)" within the IFL area, is that all logging operations in Guyana are supposedly low intensity, selective logging, and hence should fall under the category "background influence", thus not to be excluded from IFL.

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However, the kind of "low-intensity selective logging" referred to in the IFL definition does not refer to commercial logging using heavy machinery, however "sustainable" or "reduced

impact" such logging operations may be. The only logging tolerated within IFL is the use of timber by indigenous peoples and local forest communities for traditional practices such as house-building. All the activities that are listed in the definition as "background influence" are examples of traditional practices of indigenous peoples and other forest communities. This list was included to prevent the IFL concept from leading to violations of the rights of indigenous peoples to their lands and natural resources, and to recognize the sustainability of their traditional practices. While it is true that indigenous communities also sometimes engage in logging that leads to significant forest degradation and thus exclusion from IFL, especially where they engage in commercial logging involving machinery, roads etc, it is necessary to separate commercial logging from traditional, sustainable practices. That is why the IFL does not outright ban all logging.

Recent literature on IFL (Popatov et al (2009), Thies et al (2011) makes it very clear that commercial, selective logging is not acceptable under IFL. In fact, to allow it would render the concept virtually meaningless. Using IFL as an interim indicator for Norway's agreement with Guyana could create a strong incentive to prevent fragmentation of intact forests, but allowing industrial-scale, selective logging operations would effectively eliminate that incentive. In order to comply with the JCN, it will be necessary to revise the IFL benchmark map to exclude all active timber production areas.

Response GFC: Sustainable Forest Management (allocated State Forest Estate) areas have actually been excluded from IFL.

Our initial statement (page 86) refers to the fact that they were taken into consideration in IFL. Map 10-1 actually shows all allocated State Forest Estate excluded from IFL.

We will make this clarification in the revised Version 1 of the report – the statement can be found on page 86.

Please note that the computations remain the same, only the statement on page 86 requires changing.

DNV: The verification team assessed the comment and the response as well as the modification on page 86 and in section 10.4 p. 108 of the report to be satisfactory.

Comment by: Rainforest Foundation, Norway

☒ NGO   ☐ Party   ☐ Other Stakeholders

Sent on: 06 July 2012

Subject: Comments on GFC/Indufor report

Comment 26: The exclusion of all mining reconnaissance and reserve areas is also problematic. Exclusion can only be acceptable if there are in fact ongoing activities in these areas which fulfil the requirements for exclusion in the IFL definition. Areas that are still intact should be included in the IFL area, irrespective of whether or not they are identified as areas where mining exploration could be initiated in the future. It is the historic and current state of the forest landscape that matters, not plans that only exist on paper. To incentivize the protection of large, intact forest landscapes, it is essential to establish a correct baseline of the total IFL area today, based on the facts on the ground. To this end it will be necessary to verify whether the mining reconnaissance and reserve areas qualify for exclusion or not.

Response GFC: The areas for reconnaissance will be subject to future mining allocation. The first indication/step towards this is the allocation of reconnaissance areas.

These areas are therefore been excluded.

DNV: *The verification team assessed the comment and the response as well as the modification on p. 109 of the report to be satisfactory and consequently finds that the excluded areas are in line with the JCN agreement. During the audit the assessment team paid special attention to the mining activities and how these were reported within the monitoring system of GFC, part of this assessment resulted in the team raising CL1 and CAR7.*

Comment by: Rainforest Foundation, Norway
☒ NGO ☐ Party ☐ Other Stakeholders
Sent on: 06 July 2012
Subject: Comments on GFC/Indufor report

Comment 27: While it is positive that a database of illegal logging has been created, it seems wise to maintain a default value for illegal logging in the indicator for interim measure 4, as it is fair to assume that not all illegal logging is detected by the authorities and thus entered into the database.

Response GFC:The independent verification assesses the systems in place to make this assertion regarding the robustness of the systems to track illegal logging.

There is therefore that third part verification involved. This is in addition to Independent Forest Monitoring.

DNV: *The verification team assessed the comment and the response as well as the modification on p. 117 of the report to be satisfactory. During the audit the assessment team paid special attention to the reporting of illegal logging activities.*

Comment by: The Amerindian Action Movement of Guyana ☒ NGO ☐ Party ☐ Other Stakeholders
Sent on: 06 July 2012
Subject: Comments on GFC/Indufor report

Comment 28: The members of the Amerindian Action Movement of Guyana (TAAMOG) are pleased and happy over the release of the second performance report on interim measures for Reducing Emissions for Deforestation Plus (REDD+), under Guyana's Monitoring Reporting and Verification System (MRVS).

Response GFC: The GFC in collaboration with its consultants have made efforts to improve on the year 1 mapping (2009/2010) in a number of areas. One of the major areas of improvement is in terms of including a more precise method for degradation monitoring, and another is in the use of a higher resolution satellite imagery option (5m), for forest area assessment.

There are areas for future improvement in year 3 and these will be next steps in the forest area assessment work.

> *DNV: The verification team assessed the comment and the response as well as the modification in the Preface p.5 of the report to be satisfactory.*

Comment by: The Amerindian Action Movement of Guyana

☒ NGO   ☐ Party   ☐ Other Stakeholders

Sent on: 06 July 2012

Subject: Comments on GFC/Indufor report

Comment 29: We are of the view that the second performance report is technically sound which will meet the expectations of the Guyana- Norway partnership model in the fight against Global Climate Change and its dangerous consequences.

Response GFC: Guyana sees the work on the MRVS as a national model for the country as well as for other countries involved in work on climate change. We hope to bring important lessons from this undertaking which will include both successes and challenges faced.

DNV: The verification team assessed the comment and the response as well as the modification in the Preface on p.5 of the report to be satisfactory.

Comment by: The Amerindian Action Movement of Guyana

☒ NGO   ☐ Party   ☐ Other Stakeholders

Sent on: 06 July 2012

Subject: Comments on GFC/Indufor report

Comment 30: Many thanks to the GFC for letting TAAMOG know that the second performance report has been released and congratulations to the GFC on its continued commitment and hard work to ensure that Guyana's REDD+ programme is always successful and more so participatory.

Response GFC: The GFC looks forward to the feedback from local stakeholders and welcomes the contribution of this organisation in this regard.

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

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6   REFERENCES

Documents provided by the Project Participants that relate directly to the GHG components of the project. These 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) Interim Measures Report, Version 1 dated 15 June 2012, Version 3

dated 13 July 2012 and Version 3 dated 26 July 2012

/2/ Guyana Forestry Commission: *Geodatabase with all raw and processed datasets*, January 2012

/3/ Guyana Forestry Commission: *Data Base of Illegal logging activities for the four forestry divisions of Bce, Dem, Ess and Nwd – 01 October 2010 – 31 December 2011 – Year 2*

/4/ Guyana Forestry Commission: *Data Base of Procedural Breaches for the four forestry divisions of Bce, Dem, Ess and Nwd – 01 October 2010 – 31 December 2011 – Year 2*

/5/ Guyana Forestry Commission: *Data Base of wood harvesting declarations of wood extraction activities in lands classified as State Forest– 01 October 2010 – 31 December 2011 – Year 2*

/6/ Guyana Forestry Commission: *Data Base of wood harvesting declarations of wood extraction activities in lands classified as Amerindian or Private Property– 01 October 2010 – 31 December 2011 – Year 2*

/7/ *Guyana Forestry Commission: Summary of Comments on Interim Measures Report Year 2 - Version 2*

/8/ Winrock International: *Collateral Damage and Wood Products from Logging Practices in Guyana- December 2011*

/9/ Salas, W. Hagen, S, et al. Winrock International and Applied GeoSolution:*A Pilot Study to Assess Forest Degradation Surrounding New Infrastructure. Guyana Forestry Commission. February, 2012.*

/10/ *Guyana Forestry Commission: Sampling Design and Implementation Plan for Guyana's REDD+ Forest Carbon Monitoring System (FCMS) – September 2011*

/11/ *Guyana Forestry Commission: Spatial Analyses for Forest Carbon Stratification and Sampling Design for Guyana – September 2011*

/12/ *Guyana Forestry Commission: Carbon Impact of Land Use and Land Use Change in Guyana: Emission Factors and their Uncertainties (Draft) – June 2012*

/13/ *Guyana Forestry Commission: Establishing a Reference Level for REDD+ in Guyana (Draft) – June 2012*

/14/ Sist, Plinio: 2000: *Reduced-impact logging in the tropics: objectives, principles and impacts.* International Forestry Review 2(I), 2000. Pages 3-10.

/15/ Guyana Forestry Commission: *Standard Operating Procedures for the Forest Carbon Monitoring System of Guyana* – July 2012

/16/ Durham University:*Appenidix 10 to IMR –Accuracy Assessment* Report, May 2012

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

/17/ Guyana Forestry Commission: Manual of Procedures of Key Area of Forest Monitoring, Draft version

/18/ ISO 14064-3: *Greenhouse gases — Part 3: Specification with guidance for the validation and verification of greenhouse gas assertions*, First edition, 1 March 2006

/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*

/24/   Guyana Forestry Commission: *Procedure for issuing SFP*

/25/   Guyana Forestry Commission: *Procedure for issuing TSA or WCL*

/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/   James Singh, Commissioner of Forests – GFC

/30/   Tasreef Khan, Deputy Commissioner of Forests – GFC

/31/   Pradeepa Bholanath, Head, PDD-GFC

/32/   Monitoring Inspectors& Supervisor Mabura Forest station - GFC

/33/   NashetaDewnath, Programme Officer – REDD Section

/34/   Pete Watt, Consultant – Indufor

/35/   JeffPickering , Consultant – Indufor

/36/   Andrew Meredith, Consultant – Indurfor

/37/   HaimwantPersuaud, Resource Information Officer – GFC

/38/   Jagdesh Singh – Deputy Commissioner, Forest Resources Management Division - GFC

/39/   Kerry Anne Cort – GIS/Remote Sensing Officer, Forest Resources Information Unit – GFC

/40/   ChandrowtieSookdeo – GIS/Remote Sensing Officer, Forest Resources Information Unit – GFC

/41/   Carey Bhojedat – Project Officer, REDD Secretariat – GFC

/42/   NashetaDewnath, Programme Officer, REDD Secretariat

/43/   HansrajieSookdeo, Project Officer – Data Management, REDD Secretariat

/44/   KarlonWarde, Project Officer, REDD Secretariat

Criteria of validation and verification

/45/   Government of Norway and Government of Guyana: *Joint Concept Note on REDD+ cooperation between Guyana and Norway,* 9 November 2009& March 2011

/46/   GOFC-GOLD, 2011, *A sourcebook of methods and procedures for monitoring and reporting anthropogenic greenhouse gas emissions and removals caused by deforestation, gains and losses of carbon stocks in forests remaining forests, and forestation.* GOFC-GOLD Report COP17 version 1, (GOFC-GOLD project office, Natural Resources Canada, Alberta Canada).

/47/   IPCC (2006): *2006 IPCC Guidelines for National Greenhouse Gas Inventories, Prepared by the National Greenhouse Gas Inventories Programme.* Eggleston H.S., Buendia L., Miwa K., Ngara T. and Tanabe K. (eds).Published: IGES, Japan

/48/   IPCC (1997). *Revised 1996 IPCC Guidelines for National Greenhouse Inventories.*

Houghton J.T., MeiraFilho L.G., Lim B., Tréanton K., Mamaty I., Bonduki Y., Griggs D.J. Callander B.A. (Eds). Intergovernmental Panel on Climate Change (IPCC), IPCC/OECD/IEA, Paris, France.

/49/ 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.

/50/ 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.

/51/ Consultancy Assignment Agreement between Det Norske Veritas and Norwegian Ministry of Environment including Appendices to the agreement, 10 January 2011 & Extension Agreement, 07 February 2012

/52/ Guyana Forestry Commission: *Code of Practice for Timber Harvesting 2nd Edition,* Final Version, November 2002

/53/ Poyry: *ArcToolbox model for the establishment of an IFL*

/54/ Potapov, P., A. Yaroshenko, S. Turubanova, M. Dubinin, L. Laestadius, C. Thies, D. Aksenov, A. Egorov, Y. Yesipova, I. Glushkov, M. Karpachevskiy, A. Kostikova, A. Manisha, E. Tsybikova, and I. Zhuravleva. 2008. *Mapping the world's intact forest landscapes by remote sensing.* Ecology and Society 13(2): 51.
[online] URL: http://www.ecologyandsociety.org/vol13/iss2/art51/

/55/ Intact Forest Landscapes: *Concept and definition of IntactForest Landscape,* http://www.intactforests.org/concept.html

/56/ Voluntary Carbon Standard Association: *REDD Methodology Modules (REDD-MF),* Approved VCS Methodology VM0007 Version 1.2

/57/ Det Norske Veritas: *Verification of Interim REDD+ Performance Indicators under the Guyana-Norway REDD+ Partnership, Monitoring Period: 01 October 2009 to 30 September 2010 – Year 1,* 18 February 2011

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APPENDIX A

CORRECTIVE ACTION REQUESTS, CLARIFICATION REQUESTS AND FORWARD ACTION REQUESTS

CAR ID	Major/ Minor	Corrective action request	Response by Project Participants	DNV's assessment of response by Project Participants
CAR 1	MAJOR	**Requirement**: Interim Measures 3 – Verification of Forest Management **Non-Compliance**: SOPs do not reflect all the activities in the field in two areas. **Objective evidence**: • The procedures "CARBON STOCK DAMAGE DUE TO TREE FELLING" & "MEASUREMENT OF THE REGROWTH DIFFERENTIAL DUE TO SELECTIVE LOGGING" among others outlines the work that the field team needs to do to record stock damage, however the procedure does not include conditions under which felling sites should be excluded • During field visit assessment team found that the field teams would exclude felling sites in the event that multiple trees were felled and certain level skidder activities could be observed within the felling side	The sites visited in Mabura were identified to be excluded, owing to the fact that all criteria could not be determined for the various aspects of regrowth and logging impact assessments. If assumptions on these criteria were taken, it would introduce a level of uncertainty/bias in the procedure and would therefore negatively affect the results. Felling more than one tree in a clump is not a widespread occurrence. It is not common since a GFC's Code of Practice requirement, stimulates a tree felling proximity limitation. Of the 183 field plots established 16 contained two trees and 3 contained three trees. For these plots where multiple trees were included, the variables could be clearly identified. The Standard Operating Procedure (SoP) for the System requires that in conducting logging impact on skid trails, one must unambiguously be able to differentiate damage from the skid from damage from the felled tree (the two key variables). It can be noted from clarification of the SOPs, that DNVs concerns are addressed and do not affect the results. That is, the resultant measure of emissions remains conservative and applies a technically appropriate, consistent and accurate method – a method that takes into consideration multiple trees when all required variables are clearly identified. Measurements do indeed include plots with multiple felled trees.	Following the revisions of the SOP, DNV concludes that the current practice of excluding certain felling sites which have a too high variability in terms of different origins of disturbances correctly reflects the practices in the field. The findings are properly reflected within the new SOPs **CAR is closed**

CAR ID	Major/ Minor	Corrective action request	Response by Project Participants	DNV's assessment of response by Project Participants
			Based on the comments from DNV we have revised the SOPs related to logging and regrowth. for clarification as follows: **SOP CARBON STOCK DAMAGE DUE TO TREE FELLING** If the following conditions are identified, logging plots will not be established at a felled tree location (stump found): 1. The felled timber tree crosses a skid trail where it is not possible to unambiguously differentiate between the incidentally damaged trees from the skid trail construction versus those from the felled timber tree. 2. The top and crown of the felled timber tree has been moved and log is no longer on site, thus making log length measurements inaccurate. 3. If either of the conditions 1 and 2 above affects one or more of the trees in a cluster of felled timber trees, the plot will be excluded Note: There are circumstances that occur in the field that are not specified here—in these cases the field team leader will have to make a judgment call to whether or not to establish the plot. If there is any uncertainty in being able to determine the damage created by felling the timber tree versus other disturbances (skid trails, other human caused damage, etc.) the logging plot shall not be established. This ensures consistency in methods and accuracy of data collected. **SOP MEASUREMENT OF**	

CAR ID	Major/Minor	Corrective action request	Response by Project Participants	DNV's assessment of response by Project Participants
			REGROWTH AFTER SELECTIVE LOGGING The approach is based on establishing a chronosequence of logging gaps for biomass sampling that are established in the same stratum (based on logging practice and extraction rate) at various points in time in the past. The change in biomass over the several years sampled will indicate the rate of growth (ingrowth and regrowth) of the regenerating forest. To ensure that a standard approach is used for each regrowth plot, the method is designed to accommodate plots with one felled tree only. It is possible that the logging gaps could be stratified by the number of trees in the gap, however given the low occurrence of such gaps, this is not cost effective. Also it is likely that gaps created by two to three felled trees could have faster rates of regrowth as the gaps would be larger, thus by not including these gaps the regrowth rates obtained could be underestimated—this would result in net emission from logging to be higher and thus producing a conservative result. The following methods shall be applied: 1. Identify a logging gap based on a clearly identifiable stump of felled timber tree a. Make sure that no more than one felled tree share the same gap. Plots shall not be established in gap openings created from two or more felled timber trees. Plots shall neither be established if they overlap a road	

CAR ID	Major/ Minor	Corrective action request	Response by Project Participants	DNV's assessment of response by Project Participants
			or logging deck.	
			b. If the plot dimensions overlap any skid trail, this plot shall be excluded.	
			2. Establish a rectangular biomass plot covering the entire area of the gap opening and a portion of the shaded area immediately adjacent to opening. Based on field assessments, rectangular plots should be 8m x 40m. If plot size is changed for any reason, it is important that plot size be recorded for calculation of scaling factor to be used in analysis.	
			3. Rectangular plots must be established in a way that long sides of the rectangle are parallel to the direction the tree fell.	
			a. Stump of felled tree must be 2 meters inside of the plot on the short side of the rectangle. The center of the stump shall be 4 meters away from either edge of the plot defining the long side of the rectangle.	
			b. A sapling plot shall also be placed within the regrowth plot. This plot will be placed two meter from the front of the stump, in line perpendicular to the short side of the rectangle. At 2 meter in front of stump, a square plot of 2m x 2m will be placed.	
			Revised SoPs have been forwarded to DNV – 26th July, 2012.	
CAR 2	MAJOR	**Requirement:** Interim Measure 2b – Carbon loss and indirect effect of new infrastructure **Non-Compliance:** Lack of documented	Standard Operating Procedures (SoP) for determining forest degradation in the field have been established. (Appendix 9)	Corrections undertaken by the GFC and its teams have been found satisfactory and can be replicated.

CAR ID	Major/ Minor	Corrective action request	Response by Project Participants	DNV's assessment of response by Project Participants
		SOP or existing SOPs for determining of canopy opening **Objective evidence:** • During the transect assessment it was found that field team was relied on the assessment of one team member to determine the canopy opening. • Existing SOP CARBON STOCK DAMAGE DUE TO LOG EXTRACTION is not being used during the assessment or being considered for usage in the assessments of the transects	These SoP refer to existing GFC/WI SoP (SoP Carbon Stock Damage due to Log Extraction) established, to standardise plot measurements. The relevant aspects of the SoP are attached to the Interim Measures Report (Appendix 9) and are summarised below. The procedures which were applied were standardised, and based on the procedures outlined below, and therefore, the determination by the team leader provided for consistency in methods and accuracy of data collected. 1. Navigate to the start of the transect using a GPS (GFC/WI: SOP Global Positioning Systems) 2. Record the plot using the SOP for labelling plots 3. Establish the line transect on a predetermined compass bearing running perpendicular from the disturbance. All trees 10 m either side of the transect line are included in the plot (GFC/WI: SOP Establishment of Plots). 4. Record the dbh of all live and standing dead trees along the transect > 10 cm (GFC/WI: SOP Measurement of trees). 5. For standing trees use SOP Measurement of standing dead wood, however only measurements of dbh are recorded. 6. Record incidental damage as outline in SOP Measurement of trees - Incidental damage measurements. Only dbh measurements need to be recorded. 7. Record the location of the measured	**CAR is closed**

CAR ID	Major/ Minor	Corrective action request	Response by Project Participants	DNV's assessment of response by Project Participants
			tree along the transect to the nearest metre.	
			8. Run the transect for a minimum of 100 m if the forest returns an undisturbed state, if not then continue measurement until this occur, unless field conditions prohibit measurement (i.e. swamp, or the transect encounters a deforestation event.	
			9. Record the quantitative canopy and forest floor scores at 10 m increments along the transect line as outlined below.	
			10. To calculate the biomass use the allometric equation developed by Chave et al 2005. Summarise the biomass at 10 m intervals.	
			Follow the SOP for Data Entry and add the tree measurements into the carbon stock calculator. This has been modified to cater for the additional canopy and forest floor scores.	
CAR 3	MINOR	**Requirement**: Interim indicator 2b – Carbon los as indirect effect of new infrastructure **Non-Compliance**: Accuracy assessment contains too few sample plots to provide sufficient accuracy on the degradation levels **Objective evidence:** During the current accuracy assessment it was concluded that current sample plan resulted in too few plots that contained degradation and not a high enough confidence interval can be achieved	The following recommendations have been added to the Independent Accuracy Assessment - Appendix 10 pg 36, recommendation 10. Allow sufficient time for the independent validation. The sample size used in 2012 appears insufficient for a full quantitative analysis of degradation drivers, particularly when sampling low-risk strata. We estimate that a sample of 80—100 Primary Sampling units will provide a sufficiently large sample to yield an area estimate, particularly if the additional PSUs are allocated to the high-risk	The changes applied to the Independent Accuracy Assessment have been found adequate, however, in order to close out the CAR DNV will verify the implementation and effectiveness during the year 3 assessment **CAR: Open till next verification.**

CAR ID	Major/Minor	Corrective action request	Response by Project Participants	DNV's assessment of response by Project Participants
			stratum where Year 2 degradation is most like to be found.	
CAR 4	MINOR	**Requirement:** Interim indicator 1, 2a, 2b, 3, 4, 5 **Non-Compliance:** Not all written Standard Operating Procedures (SOPs) are available **Objective evidence:** A number of SOPs have been developed by GFC and advanced to a significant extent, however not all sectors within the programme have yet drafted or defined SOPs which are part of an integrated and overall management system	SOPs for Interim Measures, including GIS aspects, have been added to the Report. This is found in Appendix 9.	DNV has checked the SOPs and the appendix 9 and has found changes to be acceptable and addressing the concerns of the CAR. **CAR is closed**
CAR 5	MINOR	**Requirement:** Stakeholder consultation **Non-Compliance:** Stakeholder consultation not completed **Objective evidence:** Following the stakeholder consultation GFC provided full feedback on all the stakeholder comments received and integrated them in version 2 of the interim report, however did not follow up with the individual stakeholders on GFC response to their individual comments with the exception of the Norway Government	All Stakeholders have received feedback on comments sent. On 14th July, 2012, Version 2 of the Report was finalised and integrated stakeholder comments received during the public release period which ended on 6th July, 2012. The Report integrated identification, in relevant sections, of stakeholder comments made and a response on each comment. Additionally, on Monday 16th July, 2012, all stakeholders received feedback directly on their comments. Emails to this effect, were forwarded to DNV on 20th July, 2012.	DNV has been able to verify that all responding stakeholders have been contacted and been informed about the GFC response to their comments. **CAR is closed**
CAR 6	MINOR	**Requirement:** QA & QC **Non-Compliance:** Not all the data is	In all 34 location included in the field data collection for the completed phase	DNV does not agree with GFC's response that only 5 biomass plots did not include

CAR ID	Major/ Minor	Corrective action request	Response by Project Participants	DNV's assessment of response by Project Participants
		completed in the data forms and or electronic sheets **Objective evidence:** Evidence was found that some of the data sheets from the forest did not contain all the information that was required to be completed.	of the forest carbon monitoring system implementation, all data fields in the original field data forms were completed. Often times in the forest of Guyana, it rains. Given these circumstances, the GFC as a part of its field procedures, uses write-in-the-rain sheets. Even with the use of these special sheets, the rain can penetrate causing some damage to the sheet. For record keeping purposes, the main data are transcribed to a new sheet. In the 34 location where field data were collected, which involved 136 plots, field data from some plots indeed did not includes some secondary elements such as GPS Equipment Number and Completion time for plot establishment – information solely for GFC's logistical planning purposes. For entry of field data into the forest carbon monitoring system, the original sheet is used along with the duplicate. In so doing, in every case, the forest carbon monitoring system is always updated in full. In **no case**, are any data missing from the physical field sheet to the electronic data sheet. The GFC, as a corrective action, has re checked all data sheets cross referencing these to the original sheets (where applicable) It should be noted that no change was needed to the electronic data system (the Tool), as these already contained all information. Scanned field sheets were supplied to DNV with corrections made.	some elements of secondary data. There were more than 5 biomass plots data sheets missing elements of field data and a lot more data sheets from logging regeneration plots as shown in the Tables below: **Biomass Plots Data Sheets** No. of sheets checked: 76 Date: 20 July 2012 | Field Data Not Completed	Sheet/Plot ID #
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GPS Number	BPHMA 5D, BPHMA 6A, BPHMA 6D, BPHMA 20A
Forest Type	BPHMA 1B, BPHMA 2C
Total Time	BPHMA 4C, BPHMA 12B, BPHMA 12D, BPHMA16B, BPHMA 16C, BPHMA 16D	 **Logging Regeneration Plot Data Sheets** No. of sheets checked: 32 Date: 20 July 2012 	Field Data Not Completed	Sheet/Plot ID #
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GPS Number	RP1KUR 13B, RP1KUR 16B, RP1KUR 17B, RP1KUR 18B, RP1KUR 20B, RP1KUR 21B, RP1KUR 22B, RP1KUR 23B, RP1KUR 24B, RP1KUR 25B,	

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CAR ID	Major/ Minor	Corrective action request	Response by Project Participants	DNV's assessment of response by Project Participants	
					RP1KUR 31B.
				Location	RP1KUR 17B, RP1KUR 20B, RP1KUR 21B, RP1KUR 22B, RP1KUR 23B, RP1KUR 24B
				Date	RP1KUR 20B, RP1KUR 21B, RP1KUR 22B, RP1KUR 23B RP1KUR 24B.
				Coordinates (for coordinate system)	RP1KUR 03B, RP1KUR 04B, RP1KUR 05B, RP1KUR 06B, RP1KUR 17B, RP1KUR 18B, RP1KUR 20B, RP1KUR 21B, RP1KUR 22B, RP1KUR 23B, RP1KUR 24B.
				Name of Recorder	RP1KUR 20B, RP1KUR 21B, RP1KUR 22B, RP1KUR 23B, RP1KUR 24B.
				Name of Crew Chief	RP1KUR 20B, RP1KUR 21B, RP1KUR 22B, RP1KUR 23B, RP1KUR 24B.
				Total Time	RP1KUR 20B, RP1KUR 22B, RP1KUR 23B, RP1KUR 24B.
				Number of People in Crew	RP1KUR 17B, RP1KUR 18B, RP1KUR 20B, RP1KUR 21B, RP1KUR 22B.

CAR ID	Major/ Minor	Corrective action request	Response by Project Participants	DNV's assessment of response by Project Participants
				DNV further checked the electronic data system and found that data missing on original sheets in the Tables above was actually recorded on the electronic data system. An explanation for this inconsistency by GFC was that, due to rainy periods, field data is sometimes recorded directly onto the electronic data system and then transcribed onto paper sheets. While this is understandable, it is important that all data transcription, regardless of whether it is regarded as 'secondary' or 'primary', is done diligently to ensure consistency between the paper and electronic data systems.
				DNV deems the information recorded in those data fields to be important not only for GFC's logistical planning purposes, but also for operational planning and evaluation and accountability. It is also important in meeting the requirement under Section 3, dot point 3 of the Joint Concept Note for reporting to follow the IPCC's reporting principles of completeness (i.e., include all relevant information to support criteria and procedures and consistency (enabling meaningful comparisons in GHG-related information). Otherwise GFC should not have included these fields on the data sheets in the first place.
				DNV also checked but found no inconsistency in the transcription of quantitative or 'primary' information between the two data management formats.
				For purposes of continuous improvement, DNV recommends that GFC considers this

CAR ID	Major/ Minor	Corrective action request	Response by Project Participants	DNV's assessment of response by Project Participants
				finding seriously because although it is minor and only affects 'secondary' information, this lack of attention to detail by those responsible for data collection and transcription could extend to quantitative or 'primary data' which would then result in major and material non-conformities requiring expensive and time consuming corrective actions. **CAR closed out, item will remain a point of attention during future verifications.**
CAR 7	MINOR	**Requirement:** Interim Measure 2b – Carbon loss and indirect effect of new infrastructure **Non-Compliance:** Degradation only includes new degradations from newly established mines but not the re-opening of existing mines **Objective evidence:** While the GFC is currently assuming active degradation will only occur around recently active mining areas. During the field assessment it has become apparent that mining companies do come back to older sites to investigate the potential for extension by digging prospection pits (of about 1.5 by 2 meters). From the current text it is unclear whether this would be falling under the definition of new or not.	The intention is to revisit areas mapped as degradation in the Year 2 assessment, to see if the extent has changed. If detected, then the extent is updated and the change is accounted for in the current mapping period. This is only possible due to the planned acquisition of high resolution RapidEye identified for Year 3 which will essentially form the second layer in the data series at 5m resolution. The SOPs as they relate to mapping have been updated to reflect this, as has the main report. Additional information has been added to the following pages, tables and figures. Appendix 9: SoP for Forest Change Assessment: • Page 5, 24	DNV agrees with the update made by GFC however the CAR will not be closed till the next verification once clarity has been obtained from the Norwegian government as well as the Year 3 data has been assessed and the current proposed process has showed to address the observations of the audit team. **CAR to be closed out during next verification**

CAR ID	Major/ Minor	Corrective action request	Response by Project Participants	DNV's assessment of response by Project Participants
			• Table 2 • Figure 7 • p. 21 section added titled Mapping Expanding Degradation • p.22 & p.23 - Table degradation around new infrastructure Updates also reflected in the main Report: • Figure 33 p.67 • Table 7-1 p. 68 P.72 section added titled Mapping Expanding Degradation We would like to add that the method that was applied for this indicator was consistent from year 1 to year 2. The GFC would follow up with the Government of Norway for the needed clarification in this area, to inform year 3 assessment.	

Clarification requests

CL ID	Clarification Request	Response by Responsible Party of the assertions	DNV's assessment of response by Responsible Party of the assertions
CL 1	**Requirement:** Interim Measure 2b – Carbon loss and indirect effect of new infrastructure **Potential Non-Compliance:** Degradation only includes new degradations from newly established mines but not the re-opening of existing mines **Clarification Sought:** While the GFC is currently assuming active degradation will only occur around recently active mining areas. During the field assessment it has become apparent that mining companies do come back to older sites to investigate the potential for extension by digging prospection pits (of about 1.5 by 2 meters) to check for gold content. This, and the related infrastructure, causes new degradation directly around the mining area, DNV seeks clarification on how this is being considered during the current mapping process.	To further clarify, the following response is provided: The intention is to revisit areas mapped as degradation in the Year 2 assessment, to see if the extent has changed. If detected, then the extent is updated and the change is accounted for in the current mapping period. This is only possible due to the planned acquisition of high resolution RapidEye identified for Year 3 which will essentially form the second layer in the data series at 5m resolution. The SOPs as they relate to mapping have been updated to reflect this, as has the main report. Additional information has been added to the following pages, tables and figures. Appendix 9: SoP for Forest Change Assessment: • Page 5, 24 • Table 2 • Figure 7 • p. 21 section added titled Mapping Expanding Degradation • p.22 & p.23 - Table degradation around new infrastructure Updates also reflected in the main Report: • Figure 33 p.67 • Table 7-1 p. 68 P.72 section added titled Mapping Expanding Degradation	Based on the clarification DNV concludes that it appear that GFC has the intention to re-assess earlier mapped degradation to map new degradation extension (see the flowchart in appendix 9 fig. 7 (p.16)). This is slightly different from revisiting all previously mapped infrastructure to map new degradation: new degradation will only be mapped if there already has been mapped older existing degradation. However, because the JCN states that degradation around new infrastructure should be mapped ("Carbon loss as indirect effect of new infrastructure"), and as such DNV deems that sufficient. Nonetheless, Guyana and Norway will have to define better what is the definition of "new" in this context. A MINOR CAR has been raised to address this **CL is closed.** **CAR7 is raised**

| CL 2 | Clarification Sought: GFC shall clarify the inconsistency in the reported value for Year 2 timber volumes in Indicator 3 –Forest Management. Indicator 3 value is reported as 3,685,376 tCO$_2$ in Table S1 (pg. viii), as 3,437,839 tCO2 in Table 10.1 (pg. 91) and as 3,685,376 tCO$_2$ in Table 10.2 (pg. 99) | In the most recent version of the Interim Measures Report: Version 3 which has been given to DNV (that version integrates stakeholder comments), all values for this indicator area reflected correctly as: 3,685,376 tCO$_2$. | Clarification has been closed out |

Observations

CAR ID	Corrective action request	Response by Project Participants	DNV's assessment of response by Project Participants
Obs1	**Requirement:** Interim indicator 3 Forest management **Potential Non-Compliance:** Errors in Mapping of activities due to the existing and passed way of position recording **Objective evidence:** During the field visit to Mabura audit team was not able to locate stumps using GFC GPS due to the fact that past GPS positions were not properly converted to current used GPS coordinates.	In the starting phase (2010/2011) of the work on the forest carbon monitoring system, preliminary data were required to be collected to inform the full design of the system and importantly, to inform the Standard Operating Procedure to be used. The current national GIS procedure for Guyana requires for all data to be recorded in Provisional South American Datum of 1956 (PSAD 56). This procedure is currently being updated to the WGS 84 datum and it is expected that this process will be updated in the near future. It should be noted that the difference in conversion between the PSAD 56 and the WGS 84, is 400m. The first field data collection for the system was conducted in Mabura and the data were collected in PSAD 56 but represented on the map as WGS 84. The Mabura plots have since been converted to the consistent data projection system.	DNV assessment team has taken note of the explanation and will continue to observe if during future audits similar issues case problems in the execution of the audit work.

Obs2	**Requirement:** Interim indicator 1, 2 and 3 **Potential Non-Compliance:** Errors in data processing & delay timelines **Objective evidence:** • In order to achieve the highest level of cloud free images GFC currently waits till end of the year to start image interpretation which leaves little time for the overall process of interpretation, accuracy assessment and interim reporting. • GFC does not apply the same level of risk assessment in their project planning as they apply in their sampling technique in which low risk and high risk areas are treated differently in the sampling levels and project management	Good process requires for annual report to, as much as possible, use data from the end of the period of assessment. The GFC ensures that this is done as far as possible. The GFC indeed conducts risk assessment in project planning. GFC however acknowledge this comment and would like the opportunity to release a revised timetable for the Year 3 assessment for consideration by Norway. This work plan would take into consideration the elements and timelines required to meet the Interim Measures (IM). • image acquisition period • image pre-processing • Studies required to report additional IM • Change mapping • QA/QC of mapping • Independent Accuracy assessment • Reporting & stakeholder consultation • External Audit of the interim measures. This is in part due to the requirement to report change as close to the end of the reporting period (December). <u>Once all images are acquired, work starts on the highest threat areas.</u> This is therefore a key consideration in the project planning. As such, the second point raised, is not the case. The GFC does prioritise area based on risk. Permission to use imagery earlier than December for Year 2, has now been granted by Norway (4 June 2012) A sample grid 24 x 24 km is overlaid and as completed these grids are colour coded. This process allows for forward planning as the team are then able to calculate the resources required to complete the task.	DNV assessment team has taken note of the explanation and will continue to observe if during future audits similar issues may potentially case problems that may affect the ability of GFC in delivering auditable results.

Further, the GFC notes that there continues to be delays in the receipt of finances by the GFC to commence the preliminary work on time. For example, for year 3 (January to December 2012) assessment year, no financing has been received by the GFC (as at end of July, 2012) to commence this work. This significantly inhibits the smooth work flow and effective planning

Forward action requests from previous verification

FAR ID	Forward action request	Response by Responsible Party of the assertions	DNV's assessment of response by Responsible Party of the assertions
FAR 1	During the on-site assessment the verification team checked the databases on wood removals from private properties / Amerindian lands, from State Forest Lands, from procedural breaches and from illegal logging. Although the databases on wood removals from private properties / Amerindian land and from State Forest Lands showed to be correct, had QA/QC measures in place to assure the consistency of the data recorded, procedures to limit the access to the data management, and transparency in order to let the verification of the data, the databases on illegal logging and procedural breaches were not so well elaborated, and there were some errors found; minor though. Hence, the RP is recommended for the next verification to improve the database on illegal logging / procedural breaches, and to put in place QA/QC measures for the quality assurance of the data recording. The implementation of these measures will have to be verified in the next verification event. Non-binding verification Additionally, the verification team recommends to the RP the implementation of a quality management system for the monitoring of the indicators and for the future MRV System. Such system assures to stakeholders on the quality of the figures reported and improves the transparency in facilitating the verification of the results by a third party.	Point noted. The GFC is not in full agreement with the comments made in that the assertion of DNV that adequate QA/QC is not being done and also the databases on illegal logging and procedural breaches were not well elaborated, and there were some quality issues identified (See CAR 4). The fact is that few if any anomalies have been identified in the audit and this audit is expected to be the only objective basis for drawing a conclusion. The conclusion for the "strong recommendation" being may be somewhat overstated. The GFC, in its efforts to continually work on all databases as part of its routine effort to improve efficiency and quality, will examine ways in which advancements can be made. In summary this recommendation will be taken into consideration. Text inserted in Section 10.3.3	Detailed spreadsheet system has been put in place that records all the infractions that have been found by the GFC staff whereby they are being split in procedural and/or illegal activities; illegal is considered to be all activities that are not covered under the licencing agreements that logging companies /individual have with GFC. Currently spreadsheet is being user protected but being transferred into an SQL system. FAR is closed
FAR 2	The RP is recommended for future	NOTED	Following the initial audit a number of new

FAR ID	Forward action request	Response by Responsible Party of the assertions	DNV's assessment of response by Responsible Party of the assertions
	monitoring periods to: orthorectify all input Landsat data, improve file/folder naming conventions, and quality control with regards to maintaining knowledge of ground control points collected and used. Furthermore, RP is recommended to introduce SOP specifying in written how the different remote sensing and GIS operations have to be performed, and stating clearly the QA/QC measures and the archiving procedures. The RP is planning to adopt or is adopting the aforementioned actions as it was confirmed during the on-site assessment. The implementation of these measures will have to be verified in the next verification event.	1. These suggestions are consistent with best practice guidelines. DNV were made aware of the time pressure of the study during their brief site visit. 2. GFC future strategy is well advanced and substantial resources have been allocated to ensure future assessments conform to SOP and good practice guidelines as appropriate. Text inserted in Section 5. Mapping Guide for digitising has been developed and attached as one step in the process.	SOPs have been introduced and GFC has made an extended effort to introduce standardise procedures throughout their operations. FAR is closed

FAR ID	Forward action request	Response by Responsible Party of the assertions	DNV's assessment of response by Responsible Party of the assertions
FAR 3	Non-binding recommendation The verification team recommends the use of additional AVHRR/GOES hotspot data in order to make a quality check of the interpretation with Landsat images in the period 1990-1999. This is available from the Brazilian fire data server at INPE. This is not compulsory but recommended by REDD sourcebook /52/, which recommends the use of images or information from different sources to check the quality of the results.	NOTED This point has been noted and will be considered in the future as far as the data is appropriately available for the relevant time periods and easily accessible. We draw your attention to the following with respect to the current situation: 1. GFC are confident that the spatial pattern of fires is consistent through time as they are intrinsic to either the vegetation type or prevailing land use. 2. The assessment process used utilises 30 m Landsat images in which a grid is overlaid and each grid inspected regardless of the presence of a fire point to ensure robust process of change detection. 3. In this context the low resolution of AVHRR/GOES (1 km pixels) is seen to provide limited assistance none the less still referenced. Additionally if these datasets are to be of use then they must be easily available. 4. Note that efforts have been made to integrate this dataset for the 1990-99 period. Our analysis of the data show some spatial; inconsistencies in some of the fire data, but nevertheless they still serve some limited purpose and value to the process applied in this instance. 5. Every reasonable attempt was also made to communicate with INPE to ensure all	FAR is closed

FAR ID	Forward action request	Response by Responsible Party of the assertions	DNV's assessment of response by Responsible Party of the assertions
		available information could be accessed - sometimes without success. We could benefit from the verification team's experience and access to this data as our attempts have not been successful despite significant effort. 6. Additionally, a temporal search was conducted using the website (http://www.dpi.inpe.br/proarco/bdqueima das/index.php?LANGUAGE=EN) No fire data for Guyana prior to 2000 is available.	

FAR ID	Forward action request	Response by Responsible Party of the assertions	DNV's assessment of response by Responsible Party of the assertions
FAR 4	Non-binding recommendation During the site visit the verification teamchecked that some quality issues encountered during the verification were due to : - The time constraint for the reporting of the interim indicators and its verification. The RP has only a few months to perform all the analysis and do the reporting; this has an obvious effect on the quality of the assessment. - The reporting period; it is important that the reporting period is adjusted in accordance with best availability of cloud free imagery. - Lack of standardization in the reporting of results and their verification. The verification team recommends to the RP and the Government of Norway to try to address these issues for future monitoring and verification events.	NOTED 1. Unlike GHG reporting where a common reporting format is prescribed, best endeavours were made to provide as much information as possible 2. GFC undertakes, with additional guidance, to improve the reporting structure, content and scope. 3. In addition, we recommend that the verification process is clearly defined in scope, depth. And timing. Clarification is sought on the extent of verification of the methodological procedures and the end product or results (outputs and outcomes) No insertion in report as this is an administrative point for Guyana and Norway to follow up on.	FAR is closed and open issues are covered by the findings of the report (Obs 2) FAR is closed
FAR 5	-An independent accuracy assessment is to be delivered 18 March 2011. RP is requested to include the conclusions of this assessment in the IMR as soon as they are available, and to discuss the implications of the presented accuracy in the historical and Year 1 estimates (Forest/Non-forest and forest change). This will serve to address comments from stakeholders and to confirm that the estimation is within an acceptable range. -Furthermore, the verification team recommends for future verification events to provide a complete accuracy assessment	NOTED This point is note and acknowledged that accuracy assessment is an expected and necessary element of the IMR and the findings assist in directing future improvement processes and informing the levels of certainty around the forest/ non forest and change estimates.	Independent Accuracy assessment has been undertaken by Durham University and it has demonstrated that the accuracy levels were within the normal range of operating. FAR is closed

FAR ID	Forward action request	Response by Responsible Party of the assertions	DNV's assessment of response by Responsible Party of the assertions
	before the end of the verification, ideally at the beginning, as this is essential to understand the error of the estimate and to provide a verification opinion. -Furthermore, in the case EVI is used again, RP is recommended to seek alternative methods to address identified limitations associated with the use of EVI.		

FAR ID	Forward action request	Response by Responsible Party of the assertions	DNV's assessment of response by Responsible Party of the assertions
FAR 6	-As part of future revisions of the interim indicators used and future improvements of the initiative, the verification team recommends accounting Interim Indicators 3 and 4 in terms of carbon units and to try to refer them as close as possible to the extraction of biomass from the aboveground carbon pool. This would provide a more complete view of the emissions due to the timber extraction. -Furthermore, as part of the next verification event, it shall be checked that the use of a correct and more appropriatelogging collateral damage factor is applied for the relevant indicator.	Not applicable.	New System has been put in place where an assessment has been made of the carbon loss consequent to the logging activities which can be related to the actual volume of timber that is being extracted. **FAR is closed**
FAR 7	<u>Non-binding recommendation</u> As part of future revisions of the REDD partnership, the verification team recommends an improvement of the stakeholder consultation mechanism of the verification. Although the partnership established a 14 day global stakeholder consultation period, in which anybody could provide their comments, the verification team has received comments from stakeholders out of the consultation period and some stakeholders were not aware of this consultation. Possible improvements could be: - Expanding the stakeholder consultation period; - Direct invitation of relevant stakeholders to provide their comments; - Improvement of the media used to invite comments;	Not applicable.	Stakeholder consultation has been increased to three weeks and active participants have been receiving direct correspondence from GFC to comment on the report (See ref Stakeholderlist). During the audit it was found that not all the correspondence had as yet received formal feedback from the GFC on their comments. However, GFC later provided evidence to demonstrate the formal feedback on stakeholder comments. **FAR is closed**
FAR 8	As part of the verification of Indicator 2a some island polygons which would fail either	Island polygons will be mapped in year 2 assessment. The mechanism for doing this will	The audit team has check the year 2 data and found it complete.

FAR ID	Forward action request	Response by Responsible Party of the assertions	DNV's assessment of response by Responsible Party of the assertions
	the 10km size or 2 km width test were detected. This was corrected by the RP as part of this verification. RP is recommended to include the cleaning of these islands in their tool to estimate the IFL. This shall be checked in the next verification event.	be determined as part of the Year 2 assessment to achieve the desired results. Whether this will be accomplished by altering the Program/tool created to map IFL, or by some other way, has not been decided. The most effective mechanism to execute this recommendation will be instituted in the Year 2 assessment.	FAR is closed
FAR 9	1. The JCN /51/ includes within the list of Degradation Indicators "the emissions resulting from subsistence forestry, land use and shifting cultivation lands (i.e. slash and burn agriculture". As stated in the JCN, this indicator is "not considered relevant in the interim period before a proper MRV-system is in place". This is clear as the monitoring of these degradation events require a complete MRV system in place capable of monitoring the changes in carbon stocks in existing forest. As a result, during the manual interpretation of deforestation carried out by the RP, any event identified which is classified as "shifting agriculture" in a certain period would be digitized and it would not be included in the figures of deforestation; this is reasonable as shifting agriculture by definition would not cause deforestation as the vegetation would recover once the land is abandoned. The digitized polygons classified as "shifting agriculture" would be kept for ulterior periods and would not be revisited until 30 years later, when it would be interpreted if the polygon would still not have forest (i.e. deforestation) or if the polygon's vegetation	From local knowledge, shifting agriculture does not lead to deforestation but may have some impact in the short to medium term on forest carbon stocks. This point was further endorsed by representatives of indigenous Communities at the MRVS Roadmap Development Workshop in 2009 when it was the strong recommendation for shifting agriculture to not be included as a deforestation activity because of it very nature. Additionally, the JCN is quite clear that shifting agriculture is to be treated as a degradation event and the indicator that speaks to "slash and burn agriculture" states the following: Not considered relevant in the interim period before a proper MRV-system is in place. The IMR adheres strictly to the JCN. DNV's recommendation on shifting agriculture in FAR 9, is duly noted and approaches to this, will be informed by JCN requirements.	Based on the interpretation of the JCN, the FAR is no longer considered relevant as it is not within the scope of the verification. FAR is closed

FAR ID	Forward action request	Response by Responsible Party of the assertions	DNV's assessment of response by Responsible Party of the assertions
	has recovered. This means that in the case the agent "shifting agriculture" is followed by a different deforestation agent, this would not be detected until 30 years later. -The verification team does not express any opinion with this regard however recommends for future improvements to analyse, as part of the REDD initiative, if the 30 years period is deemed appropriate considering the deforestation agents predominant in Guyana and how these are interrelated in time. 2.On the other hand, in Year 1, only 57 ha have been identified as "shifting agriculture", hence it seems that some shifting agriculture has not been digitized probably due to the fact that it has not been considered as deforestation as pointed out before. This does not affect the deforestation figures for Year 1. Anyway, during the next verification event it shall be checked that these events have been digitized.		
FAR 10	As part of future improvements of the interim Indicators 2, 2b and 5, RP is recommended to assess the uncertainty of the estimate provided. Indicators 2 and 2b would be affected by the uncertainty related to the data collection method (i.e. manual interpretation). For Indicator 5, it is recommended that in future verification events, the uncertainty of the estimate is assessed for the relevant year and the previous year taking into consideration different sensors and	Uncertainty and accuracy assessments are independently executed and are envisaged to be approached in a similar manner in year 2. This has also been the approach taken for this current assessment.	GFC has employed the Durham University to perform an accuracy assessment /16/, which was presented at the beginning of the project verification. This document provides an overview of the uncertainty of the mapping produced. **FAR is closed**

FAR ID	Forward action request	Response by Responsible Party of the assertions	DNV's assessment of response by Responsible Party of the assertions
	resolutions involved.		

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APPENDIX B

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 were 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 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 particularly 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 the Pacific Carbon Trust Advisory Panel.

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 SarVision, 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. He is also responsible for the setup and maintenance of the processing computer systems and local area network. Vincent is an experienced programmer (python, idl, C, C++, java) working with ENVI/IDL, 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.

Misheck Chomba Kapambwe

Dr Kapambwe holds a PhD in Carbon Accounting, a Master of Business Administration (Sustainable Business) Degree and has done a Masters Degree in Wood Science, a Graduate Diploma in Forest Industries, a Diploma in Forestry and a Diploma in Sawmilling Technology and has done short term courses in Carbon Accounting and Management. He has experience of around three years in validation and verification of numerous projects under CDM program, VCS, CCBA and ISO 14064 Standards. His experience also covers the fields of AFOLU methodology validation, forest products processing and management, environmental management and resource conservation. Prior to joining DNV having around twenty years' experience in research in the areas of greenhouse accounting (including

ecological carbon footprinting) and climate change policy. His qualification, industrial experience and experience in forestry and forest industry demonstrate his sufficient sectoral competence in forestry (technical area & sectoral competence TA 14.1 & Sectoral Scope 14).

Andres Espejo Miñan

Andres Espejo Miñan holds a Bachelor/Master Degree in Forestry Engineering. He has 6 years' experience in biomass generation, forest management, and generation with other renewables, covering the management of forestry operations, procurement of timber and biomass, management of forest states, pre-feasibility studies for renewable generation projects, etc.

He has experience in validation and verification of numerous CDM projects.

His qualification, industrial experience and experience in CDM demonstrate him sufficient sectoral competence in Energy Generation from renewable energy sources (Technical Area 1.2), Agriculture (Technical Area 15.1) and Forestry (Sectoral Scope 14).