# VERIFICATION REPORT

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

## Monitoring Period:
1 October 2009 to 30 September 2010 – Year 1

## REPORT NO. 2011-9107
### REVISION NO. 02

## DET NORSKE VERITAS

D ET N ORSKE V ERITAS

# VERIFICATION REPORT

| Date of first issue: 18 February 2011 | Project No.: PRJC-285131-2011-CCS-NOR. |
|---|---|
| Approved by *Bunt Prillar* | Organisational unit: DNV Climate Change and Environmental Services |
| Client: Ministry of Environment – Government of Norway | Client ref.: Andreas Tveteraas |

D ET N ORSKE V ERITAS
CERTIFICATION AS

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Summary:

Det Norske Veritas Certification AS (DNV) has been commissioned by the Norwegian Ministry of Environment to perform a non accredited verification of the Interim Performance Indicators reported for the period 1 October 2009 to 30 September 2010 – Year 1 as described in the Guyana REDD+ Monitoring Reporting and Verification System (MRVS) - Interim Measures Report, Version 16 March 2011 produced by the Guyana Forestry Commission – Government of Guyana.

This report provides the verification methodology, results and statement.

| Report No.: 2011-9107 | Subject Group: Environment |
|---|---|

**Indexing terms**

| Report title: Verification of Interim Performance indicators under the Guyana-Norway REDD+ partnership | | | |
|---|---|---|---|
| | Key words REDD+ Guyana Norway Interim Indicators Verification | | Service Area Verification |
| | | | Market Sector Forestry |
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| Work verified by: Misheck Kapambwe | ☐ free distribution within DNV after 3 years | | |
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| Date of this revision: 22 March 2011 | Rev. No.: 02 | Number of pages: 49 |
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## DNV VERIFICATION STATEMENT

### Verification Objective

Det Norske Veritas Certification 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 1 |
|---|---|
| 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 methodology applied for the determination of each Interim Performance Indicator, particularly those obtained via geographical analysis, follows good practices as defined by a number of reference documents (see below)

The geographical boundary of the verification is Guyana and the time period covered is 1 October 2009 to 30 September 2010 (Year 1).

### 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 (9 November 2009)

- 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 7 January 2011 until 21 March 2011 and included desk reviews of relevant documentation and datasets as listed in the verification report and an on-site assessment in Guyana from 7 February 2011 to 11 February 2011.

**Conclusions**

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

- have been obtained applying methodologies in accordance with internationally accepted good practices as defined by the verification criteria;

- are free from omissions and misrepresentations that could lead to material misstatements.

This statement is presented with the following qualifications and limitations as defined by ISO14064-3:

- The results of the independent accuracy assessment has not been fully verified

- The uncertainty level for each indicator has not been provided or defined

- The logging collateral damage factor applied for the calculation of Indicators 3 & 4 is provisional

Furthermore, recommendations for improvements in future monitoring periods are summarised as Forward Action Requests (FARs). These FARs are listed in Appendix A of the Verification Report.

DNV has verified that the values for the interim indicators in Year 1 are:

| Indicator | | Year 1 results |
|---|---|---|
| Indicator 1: | Gross Deforestation rate in Year 1 | 0.06% |
| Indicator 2: | Loss of intact forest landscapes | 7.60 million ha |
| Indicator 2b: | Carbon loss as indirect effect of new infrastructure. | 92 413 ha |
| Indicator 3: | Forest Management | 695 043 $m^3$/year |
| Indicator 4: | Emissions resulting from illegal logging activities. | 6 796 $m^3$/year |
| Indicator 5: | Emissions resulting from anthropogenic forest fires. | 1706 ha/year |

Statement Issuing date

22 March 2011

Andres Espejo                                      Stein B. Jensen
*Technical Team Leader*                            *Director of Operation*
DNV Italy                                          Det Norske Veritas Certification AS

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

## *Abbreviations*

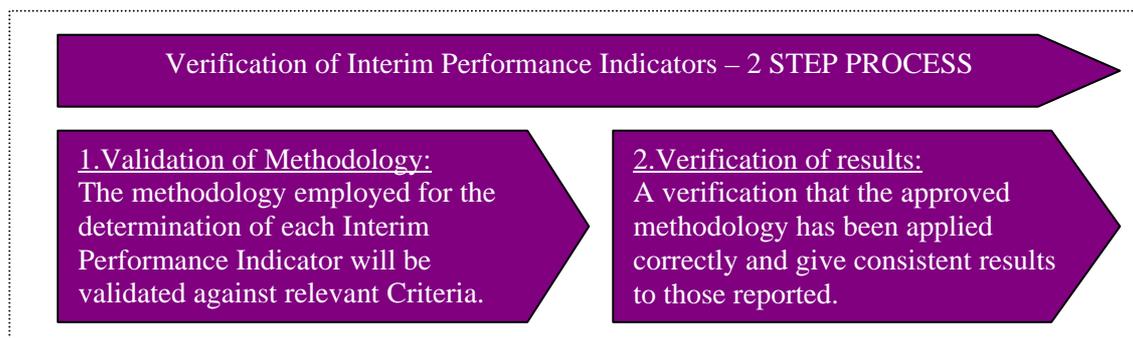| | |
|---|---|
| ALOS AVNIR2 | Advanced Land Observing Satellite Advanced Visible and Near Infrared Radiometer type 2 |
| AVHRR | Advanced Very High Resolution Radiometer |
| CAR | Corrective Action Request |
| CBERS | China Brazil Earth Resource Satellite |
| CBM | Cubic Meter |
| $CH_4$ | Methane |
| CL | Clarification request |
| $CO_2$ | Carbon dioxide |
| $CO_2e$ | Carbon dioxide equivalent |
| CoC | Chain of Custody |
| DMC | Disaster Monitoring Constellation |
| DNV | Det Norske Veritas |
| 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 |
| 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 | Voluntary Carbon Standard GHG programme (now called Verified Carbon Standard GHG programme) |
| Year 1 | First monitoring period from October 1, 2009 to September 30 2010 |

# 1  INTRODUCTION

DNV has been contracted by the Norwegian Ministry of Environment to perform a non-accredited verification of the 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 monitor accurately the emissions from deforestation /53/.

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 /53/:

1. Gross Deforestation in the period October 1, 2009 to September 30 2010 (Year 1);

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 anthropogenic 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 the ISO 14064-3 /27/. It has to be noted that this is not an accredited verification applying ISO 14064-3. This standard has served as guidance for the definition of the verification plan.

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 /27/. Therefore, it dictates the relative degree of confidence the verifier requires in order to make a conclusion /27/. There are two levels of assurance, reasonable or limited, which result in differently worded 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 /27/.

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 /27/.

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 of 16 March 2011) 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" /27/. 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) /53/

  - GOFC-GOLD REDD Source Book, 2009 /54/;

  - IPCC Good Practice Guidelines /55//56//57//58/;

  - Approved REDD methodologies under the VCS programme /59//60//61//62/;

- REDD methodologies under development to be approved under the VCS programme /63/;

- Formal clarifications from the Government of Norway /65//66/;

- Peered reviewed publications /42//72//73//75//85//74//68//71//67/

- Verification criteria:

  - Main Criteria - Joint Concept Note (i.e. Section 3: REDD-plus performance Indicators) /53/;

  - Validated analysis methodology (once validated by DNV) /1/;

  - Formal clarifications from the Government of Norway /65//66/;

## 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 /27/. Taking into consideration the TOR of the assignment /64/ and the provisions of the JCN /53/ the scope of the verification consists in the verification of the following deforestation and degradation Interim Measures Indicators as described in the JCN /53/:

| | |
|---|---|
| **Deforestation Indicators** | Indicator 1: Gross Deforestation in Year 1 |
| **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 anthropogenic 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 1 (1 October 1 2009 to 30 September 2010)

  o Benchmark periods  (i.e. 2003 – 2008 for forest management) – only as reference

- *Frequency of subsequent verification processes*: Yearly verification

- *Timing:* Submission 18 March 2011

- *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" /64/. 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 /64/.

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.

## 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) Geodatabase with all the raw and processed datasets /2/;

iii) Data Base of wood harvesting declarations of wood extraction activities in lands classified as State Forest /5/;

iv) Data Base of wood harvesting declarations of wood extraction activities in lands classified as Amerindian or Private Property /6/;

v) Data Base of Procedural Breaches for the four forestry divisions of Bce, Dem, Ess and Nwd /4/;

vi) Data Base of Illegal logging activities for the four forestry divisions of Bce, Dem, Ess and Nwd /3/;

*Verification team*

| Role | Last Name | First Name | Country | Administrative | Desk review | Site visit | Reporting | Supervision of work | Technical review | Sectoral competence |
|------|-----------|------------|---------|:---:|:---:|:---:|:---:|:---:|:---:|:---:|
| Customer manager | Pretlove | Bente | Norway | ✓ | | | | | | |
| Technical team leader | Espejo | Andrés | Italy | | ✓ | ✓ | ✓ | ✓ | | ✓ |
| Independent Expert | Schlesinger | Peter | Perú | | ✓ | ✓ | ✓ | | | ✓ |
| Internal Peer Reviewer | Kapambwe | Misheck | Australia | | | | | | ✓ | ✓ |

*Duration of verification*

Preparations: *From 15 December 2010 to 4 February 2011*

On-site verification: *From 7 February 2011 to 11 February 2011*

Reporting, calculation checks and QA/QC*: From 14 February 2011 to 22 March 2011*

## 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 the desk review of the GFC's database; 400 Gb of data with all the raw datasets and processed dataset /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 /29//30//31//32//33//34//35//36/. This served to detect the process operations with the highest levels of risk of material discrepancy, and to consequently design a verification and sampling plan.

## 3.2   Site visit

An on-site assessment was performed from 7 February 2011 to 11 February 2011; partly in GFC's main headquarters located in Georgetown, and partly in GFC's forest stations of Mabura and Linden. In order to complete the verification and sampling plan to be applied for the verification, two scoping sessions were carried out on 7-8 February 2011. The two sessions also 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 in which the verification efforts should be concentrated.

After the scoping sessions and the definition of the final verification and sampling plan, the actual verification on-site assessment was performed on 9, 10 and 11 February 2011. During these three 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 controls.

-   Team 2 – forest management and illegal logging: This team carried out the verification of Indicators 3 and 4. On the first day, a verification of GFC's databases was carried out, and on the second day, a field visit to two GFC's forest stations was carried out in order to cross-check information

On 11 February 2011 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 corrective action request (CAR) 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 significant influence on the results;
  iii.   non compliance with relevant criteria;

A clarification request (CL) shall be raised if information is insufficient or not clear enough to validate or verify against applicable criteria.

A Forward Action Request (FAR) shall be raised if a certain aspect has to be verified in the next verification event (e.g. foreseen modifications, etc.) and recommendations are being made for future improvement of the analysis process or the monitoring of the interim measures indicators.

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**

The analysis methodology applied by the Responsible Party (RP) examined over 160 Landsat 4, 5, and 7 satellite images acquired from INPE and USGS to create an image base of forest/non-forest lands (year 1990) and subsequent layers of land use change for four time periods, 1990-1999 (P1), 2000-2005 (P2), 2005-2009 (P3), and 2009-2010 (Year 1)/1//47//49//48/. The P1, P2, and P3 land use changes and their supporting satellite images constitute the database of a benchmark forest area map mentioned in the IMR /1/.

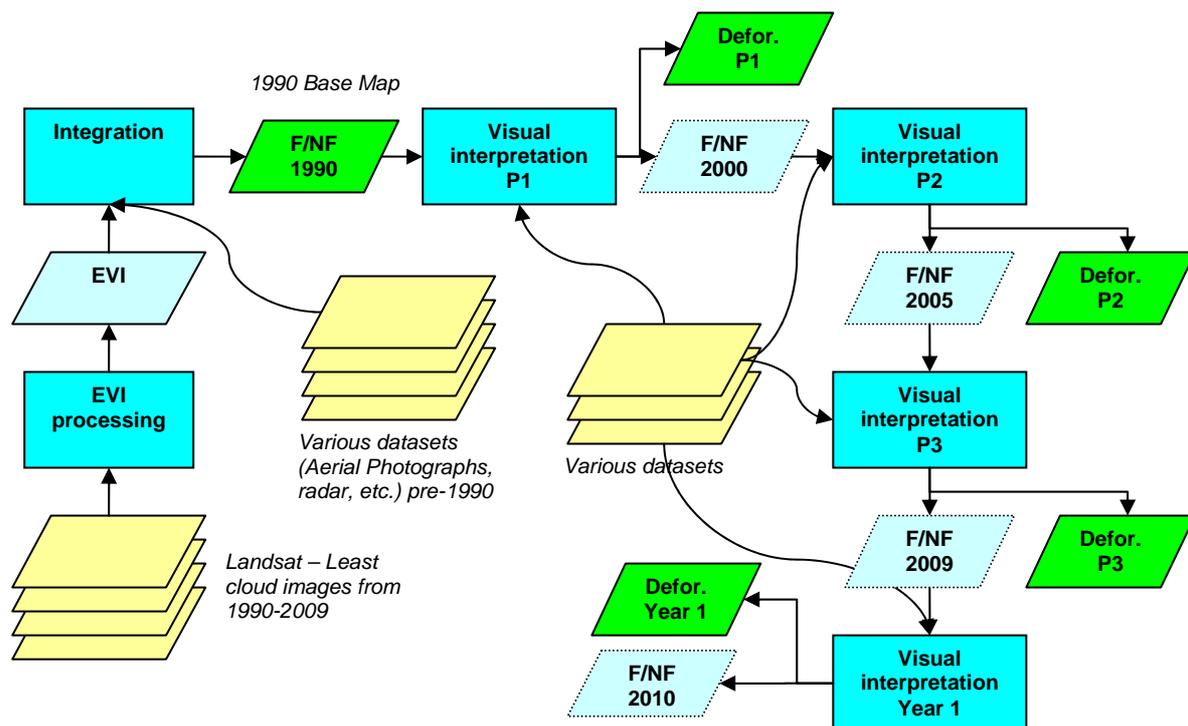The methodological process could be summarized by the following flow chart diagram (Figure 1):



**Figure 1.  Flow chart diagram with analysis process**

Generation of 1990 Base map

The approach identified all non-forest pixels using a forest mask created from all least cloud images spanning the years of 1988-2009. It is important to note that the creation of the forest mask functioned only as a starting point for what was mostly manual identification and information collection.

The area of a forest mask, consistent with the definition of forest for Guyana, needs to meet the conditions of 5 m height, 30% crown cover, and a minimum mapping unit of 1 hectare /1/.

Because height of forest cover is impossible to detect with optical data, and as Guyana's forest landscapes are characterized by not having transitional or shrub forest landscapes in which the height would be a critical factor for the forest/non-forest definition /40//47/, the focus was on determining the area of forest meeting crown cover requirements.

To produce a dataset to assess crown cover, all of the available Landsat images from 1990 to 2009 were collected from available archives and reviewed for geometric correction needs /1/. Any image not having been orthorectified to a base data set (such as GLS2000 or GLS2005) was geometrically corrected to the set of base map images for 1990 to meet an accuracy of 1 pixel /76/. All images were assessed for cloud cover. Those with significant cloud cover were removed from the forest mask processing stream, and least cloud images were selected for further processing /1//47/.

The methodology used to determine the area of the 30% crown cover used a threshold determined by a spherical densiometer, combined with enhanced vegetation indices (EVI) described by Huete *et al.* (1997) /75/ that were calculated at the resolution of Landsat (30m) with normalized data.

To calculate the densiometer threshold, fifteen transects were taken over an area of two Landsat images near the Atlantic coast with as few as 3 readings per transect; a threshold value of 0.515 was determined to be the location where crown cover met the 30% requirement /1//47//69/.

Spatialization of the transect data required calculation of a mean EVI value within 3 x 3 pixel matrices (90 x 90 m) in the vicinity of the locations where transect measurements determined sufficient crown cover /1//47/. The Landsat data in the forest mask processing stream were calibrated to top of atmosphere radiance using bias and gain settings described by Chandler et al. (2009) /1//47/ and normalized to each other using the Pseudo Invariant Features method of Du et al. (2002) /1/ and improved by Paolini et al. (2006) /1/ prior to EVI processing to improve consistency across images. Eighteen EVI data values were averaged to determine a threshold range of 0.5-0.6 and were used to determine the subsequent locations meeting the crown cover requirements for forest cover and non-forest areas /1//47//69/. SPOT and Ikonos data were used with 100 m JERS-1 radar data to assist in identifying the forest/non-forest transition zone. Also aerial photographs (1950s and 1970s) were used to define the transition. While the results were compared with 12 Savannah forest plots located in the south of Guyana that were part of the national biomass dataset, feedback comments in McRoberts et al. /69/ noted that it "is difficult based on these results to say a specific EVI value represents an exact forest cover percent value". The non forest mapping was manually assessed using the same 10 x 10 km tile approach to QC the results /69/.

Generation of deforestation datasets

Deforestation datasets were produced via manual interpretation for three different periods from 1990 to 2009 (i.e. P1 1990-2000, P2 2000-2005 and P3 2005-2009). Suitable least cloud images combining all available spatial information data of moderate and high resolutions (from ALOS AVNIR-2, Ikonos, DMC, SPOT, IRS, CBERS, and MODIS sensors) were used to capture an understanding of which pixels had changed and for what reasons /1//47//49//48/. Extraction of these changes used manual image interpretation and editing of land use changes.

Interpretation of these non-forest areas was undertaken manually using a 10 x 10 km grid superimposed over the country to assess and create a database of gross deforestation changes.

The collection of Year 1 land use changes followed the same methodology as that used in the benchmark forest area map database.

## b    Validation criteria and Indicators

Criteria noted in the JCN /53/ 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 3 February 2009[*] 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.). This provisions made in the JCN /53/ 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 /53/, GOFC-GOLD REDD Sourcebook /54/, and UNFCCC Good Practice Guidelines (GPG) /56//57//58//55/) 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[†].

Furthermore, the government of Norway provided some clarification regarding the use of earlier images (earlier than 30 September 2010 Year 1) due to the persistent cloud cover in images close to that date /66/: "the Government of Norway recommended using available, accepted methodology to adjust for the time differences of Landsat images". Hence the applied methodology took this provision into consideration.

## c    Validation of methodology against criteria

Generation of 1990 Base map

As explained above, the 1990 Base Map was produced using various sources as required by the REDD sourcebook /54/. Furthermore, the methodology has been designed to optimize the available resources, taking into consideration the country's conditions and limitations (i.e. cloud cover) as required by the IPCC guidelines /56//57//58//55/.

A first Forest/Non-forest mask (defining areas with crown cover over or under the 30%) was produced using an EVI applied to available least cloud landsat images from 1990 to 2009. The methodology used to determine the area of the 30% crown cover used a threshold determined by a spherical densiometer, combined with enhanced vegetation indices (EVI). This forest/non-forest definition would have its uncertainties due to the limitations of the methodology applied (see CL 1). This was confirmed by the RP in McRoberts et al. /69/ in which it was noted that it "is difficult based on these results to say a specific EVI value represents an exact forest cover percent value".

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[*] Extended to September 2009

[†] 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.

The Forest/non-Forest mask was completed and modified using SPOT, Ikonos, aerial photographs (1950s and 1970s), and 100 m JERS-1 radar; this assisted to identify the forest/non-forest transition zone and to detect any major errors. The non forest mapping was manually assessed using the same 10 x 10 km tile approach used for the change interpretation /69/.

Hence, as there are some methodological constraints to the methodology applied in the generation of the Forest/Non-forest mask (i.e. EVI threshold value determination), the RP has conservatively used various landsat images from subsequent periods[*] to produce the mask, and has used different image sources to complete the Forest/Non-forest map in line with the applicable criteria /54/. Furthermore, the use of manual interpretation to produce the Forest/Non-forest map will compensate to a certain extent any error of the Forest/Non-Forest mask.

Generation of deforestation datasets

While the remote sensing methodology used by the RP would not be considered as best practice /54/ as it is labor-intensive, and subject to operator interpretation error due to onscreen heads-up digitizing, for the most part it follows accepted practice. The 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 /54/. The RP applied QA/QC measures through the revisiting of 50% of the 10x10 km grid cells used for aiding the visual interpretation which presumably reduced the human error /1/. Additional QA/QC measures are recommended for future monitoring periods (see FAR 2).

Independent accuracy assessment

The verification team checked the methodology followed for this assessment /25/. According to this document, the accuracy assessment randomly-sampled forested and non-forested locations using 10 x 10 km grids stratified into regions of high and low risks of deforestation based on inclusion of such risk-based criteria as logging camps, settlements of greater than 1000 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 500m from each other (that were enlarged/buffered into 1ha sample circles -- to meet the MMU) was used to direct manual assessment of cloud-free very high resolution data. In all a dataset of 58 843 points were analyzed in a binary fashion to assess the 1990 and Year 1 deforestation maps and using a confusion matrix to measure accuracies.

Despite the limited data availability due to persistent cloud cover[†], the methodology followed meets best practice guidelines in terms of sample design and accounting for national conditions and capabilities /54/.

Conclusion

The verification team concluded that the analysis methodology used by the RP meets the applicable criteria, defined by the JCN /53/, GOFC-GOLD REDD Sourcebook /54/, and UNFCCC Good Practice Guidelines (GPG) /56//57//58//55/.

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[*] 1 from 1988, 2 from 1989, three from 1999, three from 2004, five from 2005, and 6 from 2009
[†] the permitted assessed coverage of less than 10% of the forested area

### 4.1.2 Verification of Indicator

Image processing

Radiometric normalization technique used the Pseudo-Invariant Features (PIF) methods /1/, while cloud-shadow masking methods (using 10% histogram slice of Landsat bands 1 and 6) are adequate and in line with the REDD Sourcebook /54/. All Landsat input images were selected to be of least cloud cover, and geometric correction of images was considered adequate in most cases.

A search of metadata by the verification team for all input data showed that only 15 of the 160 images in total required additional geometric correction by GFC, despite the fact that GFC had not maintained detailed records on this critical aspect of their work. An examination of all input satellite scenes demonstrated, nonetheless, that the RP had indeed produced products meeting the 1 pixel accuracy, as suggested by guidance materials, for all periods.

Analysis methods

Once all the remote sensing and GIS works had been complete and the final layers were ready, the gross deforestation rate for Year 1 was calculated using the equation suggested by Puyravaud (2003) /1/. It was calculated by determining the forest cover $A_1$ and $A_2$ at time periods $t_1$ (1 October 2009) and $t_2$ (30 September 2010) and applying the following equation:

$$q = \left(\frac{A_2}{A_1}\right)^{1/(t_2 - t_1)} - 1$$

The forest area ($A_2$) at the end of Year 1 ($t_2$) was determined by subtracting from the forest area ($A_1$) at the beginning of Year 1 ($t_1$) the area deforested in Year 1 ($A_{deforestation,Year1}$). This deforested area was obtained through visual interpretation of Landsat 2007 images and as explained in the previous section. Therefore $A_2$ would be equal to:

$$A_2 = A_1 - A_{Deforestation,Year1}$$

The forest area ($A_1$) at the beginning of Year 1 ($t_1$) was obtained by subtracting from the 1990 Forest map the deforestation in the three benchmark periods determined by visual interpretation of Landsat 5 images: P1 (from 1990 to 2000), P2 (from 2000 to 2005) and P3 (from 2005 to 2009). Therefore:

$$A_1 = A_{Forest,1990} - A_{Deforestation,P1} - A_{Deforestation,P2} - A_{Deforestation,P3}$$

Therefore, the forest area ($A_2$) at the end of Year 1 ($t_2$) would be equal to:

$$A_2 = A_{Forest,1990} - A_{Deforestation,P1} - A_{Deforestation,P2} - A_{Deforestation,P3} - A_{Deforestation,Year1}$$

Hence, in order to verify the result on gross deforestation of Year 1, it was necessary to verify each of the components of the equation stated above.

Taking this into consideration, the verification team developed a sampling plan to concentrate on the main sources of possible materiality discrepancies linked to the factors of the above stated equation. According to the REDD sourcebook /54/ the main sources of error would come from the interpretation procedure (i.e., visual interpretation), and the interoperability of different sensors or sensor generators.

It is important to note that the verification team did not design a verification and sampling plan that included a quantitative assessment of the error of the estimate as this was not within the scope of the verification as defined per the TOR of the verification /64/ and as discussed in the opening meeting with the Government of Norway. However, the verification team designed a verification and sampling plan in order to understand the basic error structure of the estimates and to detect any material discrepancies. This was done based on the provisions made in Chapter 2.6 – Uncertainties of the REDD sourcebook /54/.

Hence, the verification and sampling plan was designed to assess whether there has been errors of interpretation or interoperability of different sensors in a systematic way, for each of the 5 factors that define the gross deforestation rate in Year 1:

- 1990 Forest/Non-Forest mapping: In order to verify that the validated methodology was applied for the Forest/Non-forest mapping, 10 grid cells of 10x10 km[*] were randomly selected, and the RP was requested to perform the Forest/Non-forest mapping using the approved methodology. No material discrepancies were found and it was confirmed that the RP used a combination of the EVI, Landsat images, aerial photographs, etc for the definition of 1990 Forest/Non-forest layer as described in the IMR /1/.

- Deforestation P1, P2, P3 and Year 1: Deforestation in periods P1, P2 and P3 was obtained through visual interpretation of Landsat 5 images. Taking into consideration the provisions of the REDD sourcebook /54/ regarding the main source of error, the verification and sampling plan concentrated on assessing the quality of the visual interpretation and its effect on the gross deforestation estimates, the level of precision of the visual interpretation, plus possible omission and commission errors produced during the interpretation. Out of 50 grid cells of 10x10 km[†]:

  - 30 did not show in the first interpretation any deforestation events in P1, P2, P3 and Year 1;

  - 10 did show in the first interpretation deforestation events in P1, P2 and P3; and

  - 10 did show in the first interpretation deforestation events in Year 1.

  The RP was asked to revisit each grid cell and to perform a new visual interpretation under supervision of the verification team. In order to assure independence and that the interpretation was done with exactly the same means as the first interpretation, GFC trained staff performed the second interpretation. With the estimates of area deforested for each period for the two interpretations (initial and verification interpretation), a paired sample t-test was performed on the difference of area estimates between both interpretations for the benchmark period (P1P2P3), Year 1 and the total past deforestation.

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[*] 10 grid cells were randomly selected; this was a 5% of the population. The work had to be repeated by the same interpreters in order to avoid any bias and under supervision by the verification team. Hence the low sampling intensity due to time constraints.

[†] 50 grid cells were randomly selected; this was a 2.5% of the population. The work had to be repeated by the same interpreters in order to avoid any bias and under supervision by the verification team. Hence the low sampling intensity due to time constraints.

Regarding the 30 grid cells without deforestation, no commission mistakes were made in the second visual interpretation and no new deforestation events were identified during the second visual interpretation.

Regarding the grid cells with deforestation, the second interpretation showed in general lower values of deforestation than in the first interpretation (Table 1).

| Period | First interpretation (ha) | Second interpretation (ha) | Difference (ha) |
|---|---|---|---|
| P1 | 820 | 498 | -39% |
| P2 | 500 | 639 | 28% |
| P3 | 324 | 163 | -50% |
| **Benchmark** | **1644** | **1300** | **-21%** |
| Year 1 | 214 | 159 | -26% |
| **TOTAL** | **3502** | **2759** | **-21%** |

**Table 1. Total deforestation area in the 20 grid cells interpreted in the first and second interpretation**

In order to check if these differences were statistically representative, a paired sample t-test was performed on the difference of deforestation area interpreted per grid cell. The t-test showed that the null hypothesis (i.e. the difference between the estimates of the two interpretations are equal to zero) could not be rejected (Table 2 and Figure 1). Therefore, the deforestation estimates of the two interpretations would not be significantly different, considering the sampling performed.

It is important to note, that these results have been obtained with a small sample. Probably with a higher sampling intensity it would be possible to clarify whether the first interpretation overestimated deforestation or not.

| Period | Average difference (grid cell) | t | P (two-tailed) |
|---|---|---|---|
| **Benchmark** | 49.2 | 1.13 | p=0.3 (p>0.05) |
| **Year 1** | 6.9 | 2.01 | p=0.08 (p>0.05) |
| **TOTAL** | 39.9 | 1.23 | p=0.24 (p>0.05) |

**Table 2. Statistical results of the paired t-test sample showing that the means would not be significantly different**
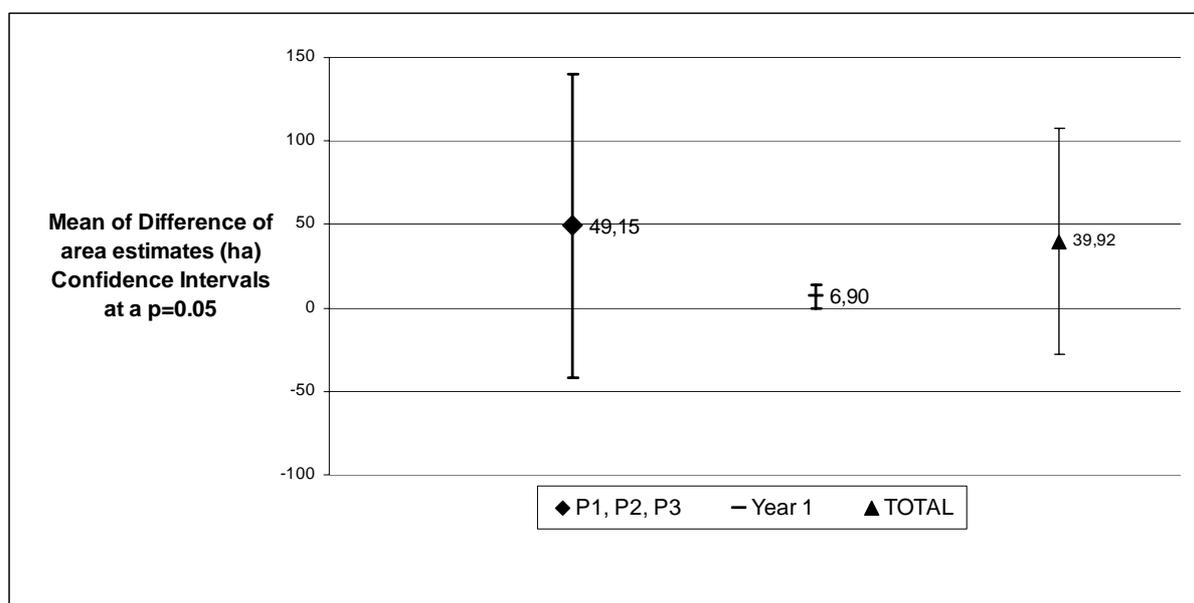
**Figure 2. Results of a paired sample t-test of two interpretations of deforestation estimates for P1, P2, P3 and Year 1**

The verification team checked the calculations of gross deforestation based on the 1990 Forest/Non-Forest and deforestation estimates, and did not find any omissions and misrepresentations that could lead to material misstatements.

| Period | Years | 1/Period | Forest area (ha) | | Total Change | |
|---|---|---|---|---|---|---|
| | | | Start | End | (ha) | % |
| **T1** | 10 | 0.1000 | 18 473 394 | 18 452 127 | 21 267 | |
| **T2** | 5 | 0.2000 | 18 452 127 | 18 417 878 | 34 249 | |
| **T3** | 4.75 | 0.2105 | 18 417 878 | 18 398 478 | 19 400 | |
| **Benchmark** | 19.75 | 0.0506 | 18 473 394 | 18 398 478 | 74 917 | 0.41% |
| **Year 1** | 1 | 1.0000 | 18 398 478 | 18 388 190 | 10 287 | 0.06% |

**Table 3. Results on gross deforestation**

Accuracy assessment

In order to confirm that the variability of the estimate would not cause a significant uncertainty of the gross deforestation value, the verification team checked the preliminary results (i.e. confusion matrix of Year 1 deforestation map and 1990 Forest/Non-forest mapping) of the independent accuracy assessment performed by the Durham University /24/ and provided by the RP. According to these preliminary results the overall accuracy of the 1990 Forest/Non-forest mapping and the Year 1 deforestation mapping is equal to 95.8% and 92.81% respectively, which would confirm the acceptable accuracy of the mapping according to the REDD sourcebook /54/ and to other applicable criteria /59//60//61/62//63/. The verification team did not fully verify the results of this independent accuracy assessment as the final results were not received within the time period of this assignment.

Conclusion

Taking into consideration all the findings obtained with the verification and sampling plan applied as stated above, and the preliminary 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.

Hence the verification confirms the gross deforestation rate in Year 1 is 0.06% with the following qualifications:

- The results of the independent accuracy assessment were not fully verified by the verification team;

- No uncertainty level for the estimates was provided;

## 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, and Year 1 land use layers and excludes them /77/. Layers buffered and excluded are water bodies (including navigable rivers and shorelines), settlements and municipalities, agricultural concessions, and areas deforested. The areas deforested had been pre-selected to contain forestry roads, infrastructure roads, mining, and/or mining roads /77/. Forestry concessions were also extracted as it would be considered as logging at an industrial scale; at low intensity though. Once these have been removed, the only polygons allowed to remain in the resulting GIS layer will be larger than 50 000 hectares and capable of enclosing a circular object of 10 km radius. Also analysis was performed in order to keep at least 2 km wide corridors or appendages to and from areas meeting appropriate conditions. All of the buffering, exclusion, area calculation, and area-based selection are performed using ArcGIS v.10 modeling code /77/. 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 is recommended to include this operation in their procedures (see FAR 8).

**b        Validation criteria and Indicators**

Criteria used to validate this methodology included the existence of appropriate input data layers, and defined requisite processes for estimation (buffering and exclusion from the input layers) were sourced from Potapov *et al.* (2008) /71/, as referred by JCN /53/. 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". Furthermore, it suggests that monitoring and estimation should use similar methods as for forest area change estimation. A footnote defines IFL "as a territory within today's global extent of forest cover which contains forest and non-forest ecosystems minimally influenced by human economic activity, with an area of at least 500 km$^2$ (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.* /71/ 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.* /71/ 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 /71/. 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 /78/ and is in line with the recommendations of Potapov *et al.* /71/.

### 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 recreated and recalculated the IFL using this model to verify the results achieved by the GFC team.

As a result, the verification team achieved the same results as the RP, and concludes that the value of IFL for Year 1 is equal to 7.60 million ha.

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

### 4.3.1 Methodology validation

**a        Methodology description**

The methodology to calculate the loss of carbon as an indirect effect of new infrastructure was achieved through isolation and buffering of new Year 1 mining and roads related to mining, forestry, and infrastructure, excluding existing deforested lands that intersected the degradation buffer (such as those from roads and infrastructures built during P1, P2, or P3) /1/.

**b        Validation criteria and Indicators**

The main validation criteria is the JCN /53/ 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 /53/ 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 /53/ 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."

**c        Validation of methodology against criteria**

The methodology applied by the RP to accept the default buffer distance of 500 meters from the outside edge meets the criteria set forth in JCN /53/. According to the MRVS Interim Measures Report /1/ there were too few high resolution scenes available to visually inspect with high accuracy the extent of degradation distance from infrastructure. The verification team agrees that existing remotely sensed data (available for this portion of the assessment exercise) are insufficient in terms of cloud-free coverage and resolution to be able to adequately measure the degree of forest degradation in the vicinity of relevant infrastructure.

The verification team concludes that the analysis methodology used by the RP meets provisions of the JCN /53/.

### 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.

As a result, the verification team achieved the same results as the RP, and concludes that the value for indicator 2b for Year 1 is equal to 92 413 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 amongst its main objectives, the enforcement of forest legality /8/. Such monitoring system has four main components in place:

- Forest Concession Monitoring: This part of the monitoring system consist of the monitoring of the concessions from a legal point of view (i.e., permitting, payment of royalties,…) and the strictness of the forest management activities performed by the concessionaires;

- Monitoring of forest produce in transit: This is the Chain of Custody (CoC) system that has been implemented in Guyana since the year 2000 /8/. This CoC system or Log Tracking System has as main objective to verify the origin of raw material and to control the level of harvesting within State Forests /8/;

- Sawmills and Lumberyards monitoring: This component consists of the verification of the legality of sawmills and Lumberyards and their operation /40/;

- Exports: This component of the monitoring system seeks to control all exportations and to check the legality of the produce to be exported /40/.

All data used to calculate Interim Indicator 3 is sourced from the <u>monitoring of forest produce in transit component. Hence the verification has concentrated on this.</u>

The existing CoC system is based on the traceability of each forest produce through the use of tags with a unique identification code on each unit of produce (log) /26/. 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 is 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 /26/.

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 in place that are currently being revised /26/.

State Forest lands

Before the logging operations commence, the operator has to request for the issuance of a removal permit in any of the existing forest stations /26/ (Figure 3). This removal permit will be filled-out with the operator's details. Each forest station records the issuance of the removal permit in specific books /50/. 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 #, 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 /26/. 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 /26/. 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 a formula that check the consistency of data, regular consistency checks, restricted access to the database, etc).
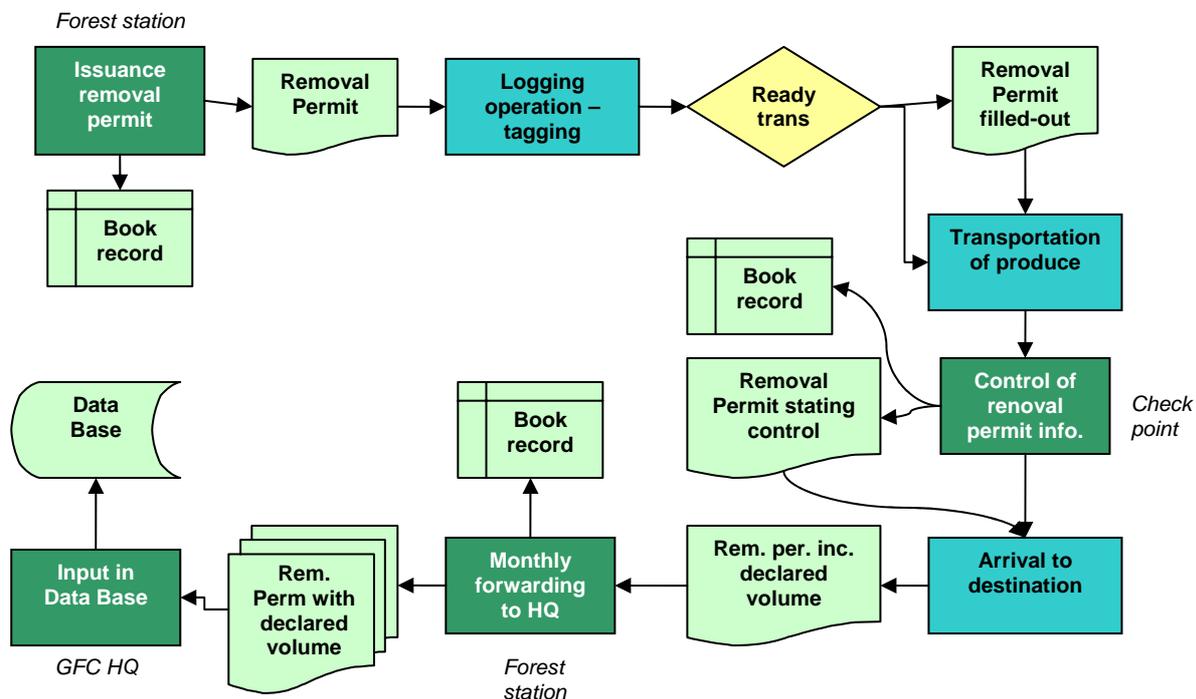


**Figure 3. Monitoring process flow chart – State Forest Lands**

Private Properties / Amerindian lands:

As these are private lands, the owner is not required to request a removal permit before the logging commences; however it is 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.
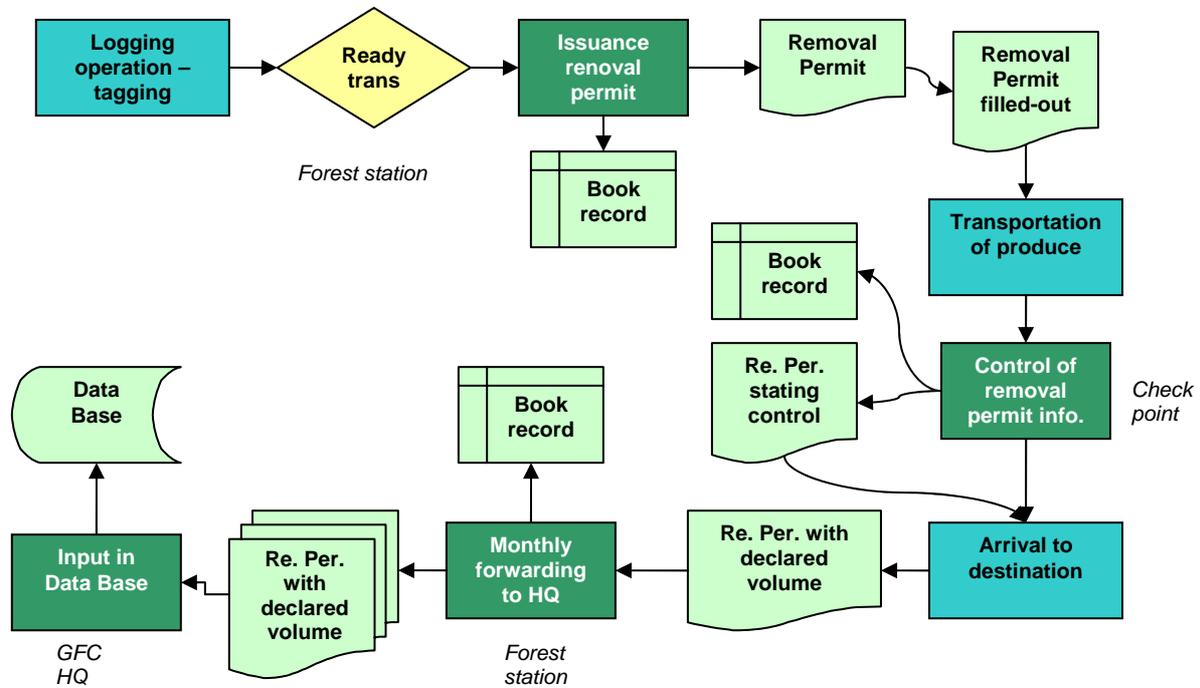


**Figure 4 Monitoring process flow chart - <u>Private Properties / Amerindian lands</u>**

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

In case the extraction of a wood produce 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 /46/. 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 1 are the total volume in CBMs extracted 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 Sawnwood, the aforementioned values (279 941 CBM and 74 412 CBM respectively) are divided by 0.7852 and 0.5 respectively (i.e. 365 522 CBM and 148 824 CBM), as the declared volume is not real volume felled but commercial volume extracted.

The total volume in CBMs of all produce declared (or produce measured in the cases of illegal logging) during the Year 1 monitoring period is then increased by 25% in order to account for logging damage; this damage is the collateral damage caused by the logging operations. The applied logging damage factor is sourced from Sist (2000) /23/ who states

that generally for Latin America a logging intensity of 5-7 trees/hectare (equivalent to volume of 30-50m$^3$) leads to damage of 25-40% of the original population of trees (in terms of trees injured or killed). Based on this the GFC has considered a 25% as logging damage factor considering the current logging intensity (at a maximum of 10 m$^3$/ha).

This value is compared with the data available of wood harvested for the period 2003-2008.

### b    Validation criteria and Indicators

According to the Joint Concept Note (JCN) on REDD+ cooperation between Guyana and Norway /53/ one of the degradation indicators will have to do with forest management (i.e. selective logging) activities in natural or semi-natural forests. According to the JCN /53/:

- "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 through "Data on extracted volumes is collected by the Forestry Commission. Independent forest monitoring will contribute to verify the figures" /53/.

Furthermore, the Government of Norway made a clarification regarding what would be considered as extracted volume: "the extracted volume indicator should be as related as possible to actual biomass removals from the forest". This would imply that the extracted volume makes reference to the total biomass removed from the aboveground carbon pool, which is closer to giving a reference on the forest degradation than the commercial volume harvested. Therefore, the methodology should take into account this provision.

### 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. This is a 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 /40//50/ 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 (Linden and Mabura forest stations were audited).

The RP showed to know the procedures in place, and no evidences were identified that could lead to believe that the monitoring system is not robust.

Regarding the calculation part of the methodology, the extracted volume is expressed in real CBM extracted and a 25% logging collateral damage factor is applied. The 25% logging collateral damage factor is not well substantiated and the verification team has recommended a forward action request for this to be addressed in the next verification (see FAR 6).

The verification team concludes that the analysis methodology used by the RP meets provisions of the JCN /53/. However, this conclusion serves only for Year 1 and its validity for next verification events will depend on whether FAR 6 is addressed.

### 4.4.2  Verification of Indicator

In order to verify the reported assertions of Indicator 4, 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 and Linden forest stations were cross-checked against database records;

As a result, the verification team did not detect any discrepancy, that the reported assertions on Interim indicator 3 - Forest Management is equal to 695 043 $m^3$/year.

## 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 /46/. In the case it is demonstrated after investigation that a certain operation is not considered illegal logging or a procedural breach, the respective record is cancelled from its 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) on REDD+ cooperation between Guyana and Norway /53/ one of the degradation indicators will have to cover illegal logging activities. According to the JCN /53/:

- "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 /53/, 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, 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;

As a result, the verification team detected some small discrepancies, which were corrected by the RP. The estimated illegal logging rate for Year 1 is equal to 6 796 m$^3$/year.

## 4.6 Interim indicator 5 - Emissions resulting from anthropogenic forest fires

### 4.6.1 Methodology validation

In accordance with the JCN /53/, 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. This is part of an ongoing effort to add to the existing knowledgebase on the causes of land use change in Guyana.

Input data used for the calculation of emissions from anthropogenic forest fires in Guyana are consistent with the Greek Risk-EOS case described in the GOFC-GOLD REDD sourcebook /54/ in that a comprehensive burned area product 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 /54/. 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 /54/, none were available for this effort.

The verification team concluded that the analysis methodology used by the RP met the letter of the guidance in the best practice document, as advised by the GOFC-GOLD REDD Sourcebook /54/. The verification team found the analysis methodology to be in line with the applicable criteria.

### 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 data used by and made available by the RP.

According to the reported assertions the total burned area in the analysis period was 33 694 ha, and using a value of 19.75 years, this would give a calculated the rate of burn to be 1 706 ha/year.

The verification team confirmed that this figure is consistent with the verification result.

## 5    COMMENTS BY STAKEHOLDERS TO REPORT

The Interim Measures Report was published for public comments from 31 October 2010 to 17 October 2010 in Guyana Forestry Commission's web page. 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.

Additionally, comments received by DNV before the 18 of February 2011 and out of the official period for public comments are also given in the below box. Comments received after this date have been forwarded to the Government of Norway and GFC for follow-up.

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**Comment by**: Regnskogfondet/Rainforest Foundation Norway

☒ NGO                    ☐ Party                    ☐ Other Stakeholders

**Sent on:** 16 February 2011

**Subject**: Comments on GFC/Poyry report

**Comment 1**:

*I am of the opinion that GFC/Poyry's interpretation of IFL is completely wrong when they allow for the inclusion of logging operations within these areas. The Joint Concept Note of the Guyana-Norway agreement refer to the definition of IFL that is found on www.intactforests.org, and also refers to this website for information about the concept. On that website, in the paragraph immediately following the technical definition of IFL, it says explicitly that areas where logging is going on shall be excluded from IFL:*

*-"Areas with evidence of certain types of human influence are considered disturbed and consequently not eligible for inclusion in an IFL:*

*-Settlements (including a buffer zone of 1 km);*

*-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 (including in all cases a buffer zone of 1 km on either side);*

*-Agriculture and timber production;*

*-Industrial activities during the last 30-70 years, such as logging, mining, oil and gas exploration and extraction, peat extraction, etc."*

*Then follows a list of activities which do not lead to exclusion, but which are termed "background influence": "Sources of background influence include local shifting cultivation activities, diffuse grazing by domestic animals, low-intensity selective logging, and hunting."*

*The kind of "low-intensity selective logging" referred to here is the use of timber from indigenous peoples and local communities for traditional practices such as house-building. All the activities that are listed 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*

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*commercial logging involving machinery, roads etc, it is necessary to draw a line between commercial logging and traditional, sustainable practices. That is why the IFL does not outright ban all logging. This has been interpreted as a loophole by GFC/Poyry.*

*The GFC/Poyry report declares all logging in Guyana to be "background influence", without providing any credible arguments for this. The report claims that there is no industrial scale logging going on in Guyana, without defining this concept or providing arguments for it. By doing this, the IFL concept is effectively emptied of meaning. The reason that the IFL concept was originally adopted in the Guyana-Norway agreement was to prevent new forest areas from being opened to logging. No matter how strict regulations Guyana may have, significant forest degradation is caused by the logging in Guyana. The JCN acknowledges this, and contains provisions on collateral damage, degradation caused by logging roads, skid trails etc.*

*The interpretation of IFL in the GFC/Poyry report is either a result of a lack of understanding of the difference between industrial logging and the traditional practices of indigenous communities, or of a conscious attempt to manipulate the terms of the agreement between Guyana and Norway. If this is allowed to stand, it would not only render useless the concept of IFL, but seriously damage the credibility of the Guyana-Norway agreement. If the GFC does not acknowledge the impacts of the country's forestry operations, it won't have any motivation to try and reduce them.*

**DNV:** *The verification team has raised* CAR 5 *asking the RP to correct the analysis methodology applied.*

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**Comment by**: Regnskogfondet/Rainforest Foundation Norway

☒ NGO                    ☐ Party                    ☐ Other Stakeholders

**Sent on:** 22 February 2011

**Subject**: almost 80% increase in Guyana log exports

**Comment 1**:

*In case it could be useful to your report on Guyana, here is an excerpt from ITTO's Market information Service (MIS):*

*"Surging log exports prop up earnings in 2010 The total exports of forest products from Guyana in 2010 were valued at US$49 million, up 7.89% compared to 2009. However, only exports of logs showed a sharp increase of 68.6%, from US$10 million recorded in 2009 to US$17 million in 2010. The total export volume of logs also soared 78.3% compared to 2009." http://www.itto.int/mis_download/*

*Almost 80% increase in volume of log exports during the first year of the Norway-Guyana agreement is remarkable, and combined with the agriculture minister's recent threats to revoke logging concessions that don't produce the maximum quota allowed and give them to concessionaires that pledge to log as much as legally possible, it doesn't bode well for the future of Guyana's forests.*

> **DNV:** *The verification team has raised* CL 3 *asking the RP to explain the inconsistency of the source with the data reported*

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**Comment by**: John Palmer - Senior Associate, Forest Management Trust, Gainesville, Florida, USA

☐ NGO    ☐ Party    ☒ Other Stakeholders

**Sent on:** 4 February 2011

**Subject**: Staebroeks news. Letter to the Editor:

**Comment 1**:

*Page 87: "Industrial-scale exploitation of timber… is not practiced in Guyana in the period under review" (1990-2010). That seems a strange claim when more than 550,000m3 of timber were reported as produced in 2000 and 2006 (including logs for Barama's plywood mill), and even 513,000 m3 [this should be 368,000 m3 – j r palmer] in the low year of 2009; as well as booming exports of unprocessed logs almost all for manufacture in Asia (over 99,000 m3 in the 11 months to November 2010).*

**DNV:** *The verification team deems that the mentioned statement makes reference to the fact that logging in Guyana has medium/low intensities.*

**Comment 2**:

*One of the conditions for Norwegian money is 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." The MoU uses the standard definition of an intact forest landscape (IFL): 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). The definition is qualified by admission of some "[which are] Areas with evidence of low-intensity and old disturbances are treated as subject to 'background' influence and are eligible for inclusion in an IFL. Sources of background influence include local shifting cultivation activities, diffuse grazing by domestic animals, low-intensity selective logging, and hunting." The GFC claims that for the logging concessions which it administers "Harvesting in managed forest areas is small-scale and selective," contrary to the findings of the Edinburgh Centre for Tropical Forestry, SGS Qualifor, and even the GFC itself (in surveys which showed the heterogeneity of logging, with areas unharvested at all being mixed with areas severely over-harvested in 'reefs' of high-value timber). Thus the GFC's inclusion of the heterogeneously logged areas does not meet the intact forest definition and qualifier, and the 3.8 million ha of TSAs should have been excluded from the claimed 10.2 million ha of IFL on page 83 of the Poyry report.*

*It is, moreover inconsistent to include the TSA logging concessions within "intact forest landscapes" but to exclude "Historical and current mining areas including allocated concessions and the associated infrastructure from 1990 to 30 September 2010" (page 87).*

*Page 40: "In Guyana's context forest areas under SFM [sustainable forest management] that adhere to forest code of practice would not be considered deforested as they have the ability to regain elected crown cover threshold." This implies that the 24 logging concessions with long-term (25 years) licences covering 3.8 million ha are excluded from the deforestation count, no matter how bad is their actual fieldwork, because the GFC does not publish which of those concessions are obliged by the terms of their TSA licences to comply with the otherwise voluntary Code of Practice for Timber Harvesting (second edition, November 2002).*

**DNV:** *DNV has raised* CAR 5 *asking the RP to correct the analysis methodology applied.*

**Comment 3**:

*Perhaps the most extraordinary feature of the Poyry-GFC report is the complete absence of reference to the GFC estimates made repeatedly to the World Bank's Forest Carbon Partnership Facility (FCPF) that in 2007-8 there were 54,000 ha deforested. The table shows the tremendous and unexplained discrepancies between the current and previous GFC estimates.*

**DNV:** *The verification team has raised* CL 2 *asking the RP to explain this difference in the IMR.*

**Comment 4**:

*There are plenty more oddities in this report, such as the total absence of cross-checks with the supposedly intensive GFC records for forest management planning, mapping of annual logging areas and timber-tagged production.*

**DNV:** *The verification team has raised* CL 4 *asking the RP to include in the IMR more information on how the extracted volumes are estimated*

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**Comment by**: Ministry of Environment (Miljøverndepartementet) – Government of Norway

☐ NGO   ☒ Party   ☐ Other Stakeholders

**Sent on: 18 November 2010**

**Subject**: Comments on Report on Interim REDD+ Indicator under the Guyana - Norway REDD+ Partnership for the period October 1 2009 to September 30 2010

**Comment 1**:

*Summary: The text on "allowable threshold" of deforestation should be rephrased. The Joint Concept Note contains the explicit note " ..no national increase in deforestation over an agreed level that should be as close to historical levels as is reasonable [...]" as a precondition for Norwegian support from 2011 onwards." When rephrasing, we would appreciate reference to the clarifying technical note which says: "In other words, Norway will only provide financial support to Guyana's REDD-plus efforts if the country does not exceed historical deforestation levels. The only exception, and a minor one, to this would be if research and analysis over the next year strongly indicate that deforestation rates in Guyana are extremely low in the order of magnitude of 0.05% or the like. In that case, minor upward variations would probably have to be accepted... I'.*

*RP: The section of the Joint Concept Note that addresses this has been added to the text.*

*DNV: IMR has been updated*

**Comment 2**:

*Section 1: We believe it would be useful to include (in this or another section) some more information on the national process in implementing the MRV roadmap, i.e. MRV steering committee, institutional setup, the development of national MRV capacities and progress in cooperation among key agencies, stakeholder involvement etc. We suggest that such a description of developments in building Guyana's own MRV capacities is included in all further progress reports.*

*RP: Text inserted on this in Section 1*

*DNV: IMR has been updated*

**Comment 3**:

*Section 2.1. We note and appreciate that Guyana has adopted a forest definition based on the Marrakech accord.*

*RP: Noted.*

*DNV: N/A*

**Comment 4**:

*Section 3.1. We have taken note of the advice of adjusting the reporting period in accordance with best availability of cloud free imagery. The potential implications of this will need to be thoroughly analysed and discussed before a decision is made.*

*RP: We agree.*

*DNV: The verification team strongly recommends this and has included this as* FAR 4.

**Comment 5**:

*Section 4.2. It is unclear whether MODIS was used for the current report. There are some deforestation patches larger than 20ha but the value of MODIS imagery in the deforestation pattern such as in Guyana is unclear.*

*RP: The following text has been added to the report to clarify the way in which MODIS has been used. For the interim reporting period MODIS imagery provided the only low cost option available in the absence of Landsat images. In this case it used to check for evidence of large-scale forest change (i.e. roading infrastructure, expansion of mining) in areas that were persistently covered in cloud.*

*DNV: IMR has been updated and the response is deemed satisfactory*

**Comment 5**:

*Section 5.4. Automatic change detection is used, but no proof is provided that the algorithm actually works well for all types of deforestation. Using only automatic change detection may cause serious ambiguities and the change detection is apparently not yet addressed by the accuracy assessment.*

*RP: The following text has been added to the report to clarify the way in which automated methods have been used. It should be noted that a perquisite for successful detection of change is cloud-free imagery. The high cloud cover in single date and multi-temporal scenes prevented the extensive use of automated techniques. Overall manual interpretation was conducted on more than 90% of the images analysed*

*DNV: IMR has been updated and the response is deemed satisfactory*

**Comment 6**:

*Section 6. We note the scheduled validation of mapping results in January 2011, and believe this will be of great significance. More information on this exercise would be appreciated.*

*RP: A detailed accuracy assessment is being carried out in the meantime.*

*DNV: An accuracy assessment is being carried out by Durham University.*

**Comment 7**:

*As we understand it, the plan is to repeat the use of high resolution images on a higher number of locations. Given the importance of achieving high precision in the forest/non-forest classification, we would encourage you to involve international experts on accuracy assessment design in developing the ToRs and/or executing the validation exercise. We would be happy to provide names of such experts if deemed useful.*

*RP: Thank you for your continuing support.*

*DNV: An accuracy assessment is being carried out by Durham University. International experts have been included in this task.*

**Comment 8**:

*The initial validation approach demonstrated, i.e. random sampling within a set of locations, represents a sound and simple approach to assessing accuracy in the selected locations. However, there is no information in the report on the basis for selecting these four locations. Can it be assumed that they are representative for the country as a whole?*

*RP: We have completed this section in the report and would direct the reader to section 9 of the revised interim report.*

*DNV: IMR has been updated and the response is deemed satisfactory*

**Comment 9**:

*We note from the error matrices that there is a certain bias in the estimates, although not statistically significant. Such biases could be reduced or eliminated by using the random sample of validation points as part of the estimation. However, it would require that the high resolution images also are selected according to a statistically rigorous sampling design.*

*We note that a quality check on the change detection is still being conducted. We look forward to seeing this. Do you plan to validate the accuracy of classification in historical images (i.e. by using historical high res. images), or assume that accuracy is the same when analyzing images from different points in time?*

*In general, we miss a discussion of how the uncertainties in estimates, and the pending valuation exercise, influence the conclusions that are drawn re deforestation figures in the historical periods and for the first reporting period. These conclusions are presented without an error margin, but there are obvious reasons to expect that the error margins could be considerable.*

*Given the importance that a change of deforestation rate will have in calculating Norway's economic contribution to Guyana, it would be of great interest to have data on the certainty of reported increase from 0.02% to 0.06% annual deforestation. Is it possible that these figures fall within each other's margin of error?*

**RP:** *Not responded*

**DNV:** *The verification team has requested to the RP to discuss the uncertainty of the estimates as part of* CL 5

**Comment 10:**

*Section 7.0. We fully understand and agree that areas under SFM that adhere to forestry code practice should not be considered deforested. However, it could be useful if possible to see data on the extent of the area that currently has crown cover below the 30% limit without being classified as deforested.*

**RP:** *Generally the spatial pattern of selective harvesting is discontinuous, so it is difficult to map these areas individually using the Landsat. The approach taken was to map the spatial extent of the harvest area rather than each area individually.*

*The following example shows an area where harvesting has occurred and the general extent of the activity. For reference a 1 ha circle is also shown. This represents the MMU. Non-forest areas are also identified. These areas were non-forest as at 1990, so do not constitute change.*
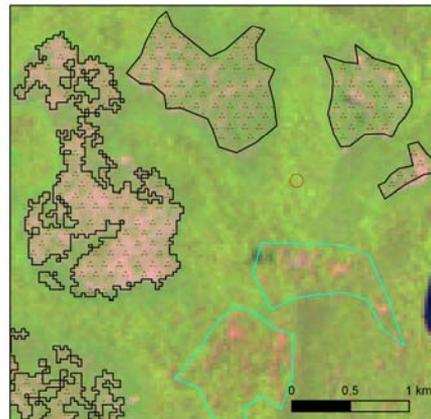
*In instances where forest cover was reduced to <30% these areas were classified as deforestation events. This includes roads and log landings. These areas are tracked temporally through time. Some areas have shown signs of recovery, but we are unsure of the capacity for regeneration. This would need further work to see if areas recovered to a 'forested' state.*

*In addition a GIS layer was created that shows forest and non-forest and it is possible to overly the allocated forest concession to see which areas are classified as non-forest.*

**DNV:** *IMR has been updated and the response is deemed satisfactory*

**Comment 11:**

*The paragraph starting "For the benchmark reporting period [... ] are not required to be reported" should be rephrased, given that the interim indicators do include some degradation indicators that will need to be reported upon.*

**RP:** *This paragraph has been re written to say the following; For the benchmark reporting period and the interim phase of the MRVS certain changes such as shifting cultivation and*

*changes associated with forests under SFM are not required to be reported spatially. Additional interim measures are in place to monitor harvest volumes from forests under SFM.*

**DNV:** *IMR has been updated and the response is deemed satisfactory. A recommendation is made regarding the consideration of shifting agriculture for future monitoring events (See FAR 9).*

**Comment 12:**

*Section 7.1. No indication is given on how the missing data caused by cloud cover are handled in the estimations of forest/non-forest and in estimating change? Cloud/no data masks should be provided for all points in time and most importantly for each of the change periods to spatially showcase where change cannot be observed. Figures 7.1 and 7.2 are already very good starting points for this.*

**RP:** *The cloud masks for all time periods have been created and are included in section 7.1. The following table provides a summary of the percent cloud cover for each period. Using all available images for each period the cloud cover ranges from 1.8% to 4.4%.*

**National Cloud Cover by Period**

| Period | Cloud cover (%) |
|---|---|
| 1990 | 4.4 |
| 1990-2000 | 4.4 |
| 2000-2005 | 3.6 |
| 2006 - 2009 (Sept) | 1.8 |
| 2009-2010 (Sept) | 2.9 |

**DNV:** *The verification team has requested to the RP to discuss in the IMR how the missing data caused by cloud cover are handled in the estimations of forest/non-forest and the changes. This is required in* CL 6

**Comment 13:**

*Section 7.7. Do you have information of the percentage of fires that actually cause deforestation and how many are just agricultural fires?*

**RP:** *The spatial pattern suggests that most fires occur in non forest areas. For the year 1 period of the 2038 fires detected by MODIS 25% of these plotted in forest areas with the remainder in non forest areas. For the year 1 period only a small area (32 ha) of deforestation was mapped based on the fire point location.*

*In making this calculation all fire points were assumed to be anthropogenic. Best efforts were made to investigate the location of each fire point to determine if resulted in deforestation (Biomass burning). Shifting agricultural practices are most likely to use fire as a land*

*clearance tool, but this activity was not considered to cause deforestation unless the change was to permanent agriculture. Further work is required to determine the long term impact of this practice on carbon stocks and also additional efforts would be required to check the accuracy of the fire point dataset.*

*DNV: The response is deemed satisfactory. A recommendation is made regarding the consideration of shifting agriculture for future monitoring events (See FAR 9).*

**Comment 14:**

*We appreciate that the report also includes a breakdown by forest change drivers. This will be valuable information for assessing where interventions may be needed and to subsequently evaluate effects of such interventions.*

*We would strongly recommend that significantly more focus is put on the uncertainties of the estimates. A fundamental improvement would be to provide the error estimates (standard error) of the deforestation rate estimates for the different periods, as well as for the change from the historical period to the reporting period. We expect the further validation work that is in progress will contribute to reduce the level of bias in the estimates of forest/non forest and in the change estimates.*

*RP: Yes we agree that this analysis would assist with providing confidence in the deforestation estimates. The independent accuracy assessment that will take place in January 2011 will address this.*

*Unfortunately the availability of historical high resolution imagery <10 m is very restricted over Guyana. All efforts were made to source these images . Table 4.2 from the report shows what high resolution datasets are available for Guyana.*

| Application | Satellite | Spectral Bands | Resolution | Image Extent (km) | Coverage |
|---|---|---|---|---|---|
| Land use & Forest Change Mapping | SPOT | VNIR & SWIR[1] | 5, 10 or 20 m | 60 x 60 | Full coverage but cloudy |
| | CBERS[2] | VNIR | ~20 m | 120x 120 | Scattered |
| | DMC | VNIR | 22 m & 32 m | 660 x 4100 | Scattered cloud |
| | ResourceSat1 (IRS) | VNIR & SWIR | 23.5 m (LISS-3) 56 m AWiFS | 142 x142 & 774 x 774 | Scattered only 2 LISS-3 scenes available |
| | Landsat 5 & 7 | VNIR & SWIR and thermal bands | 30 m VNIR & SWIR 90 m thermal | 185 km | Full temporal coverage to Sept 2009 |
| Monitoring Broadscale Forest Change | Landsat MSS | VNIR | 80 m | 185 km | Scattered pre 1990 |
| | MODIS | VNIR | 250 m | Approx. 2000 km | Daily coverage from two satellites Terra & Aqua. Complete coverage for end Sept 2009 and 2010 |
| Radar | Palsar RADAR | Single and dual polarisation | 50 m | ~70 - 70 | Selected scenes provided by GEO FCT for 2008-09 period |
| | Aerial photography | Panchromatic with some colour images around coastal areas | 1:40 000 | Unregistered | Historical spanning from 1950-1970 |
| Verification & Accuracy Assessment | IKONOS | VNIR | 1 m pan 4 m multi-spectral | 11 x 11 km | Scattered around coastal regions |
| | Kompsat 2 | VNIR | 1 m pan 4 m multi-spectral | 16 x 16 km | Scattered |
| | CBERS (HRC) | Panchromatic | 2.7 m | 27 | Scattered |
| | SPOT 5 | VNIR & SWIR | 2.5, 5 m & 10 m | 60 x 60 km | Scattered |
| | ASTER | VNIR & SWIR & thermal bands | 15 m | 60 x 60 km | Scattered |
| | ALOS | Visible & near infrared | 10 m | 70 x 70 km | Scattered |

*The location of these scenes is also provided below with indicative cloud cover scores . These scenes represent the best available data over at the time of the analysis. The selection includes scenes > 10 m and on many of the scenes identified cloud cover is still an issue.*

*The following notes relate to the datasets available*

*Aerial photography is not current and is not geo-referenced*

*-IKONOS is available and of good quality. The coverage is restricted to the coastal zone*

*-Kompsat2 data is in the archive all data identified is < 20% cloud cover but was not purchased due to time constraints. Potentially this dataset would be of value to the independent accuracy assessors*

*-CBERS HRC - this dataset has been acquired by GFC . The radiometric quality is quite poor and cloud cover is an issue.*

*-SPOT 5 data (10 m mostly ) is available at GFC  and the lowest cloud cover scenes have been identified. The low resolution of this dataset is also an issue*

*-ASTER and ALOS. The lowest cloud cover scenes have been identified and this data has been purchased by GFC. The low resolution of this dataset is also an issue.*

*-RapidEye data is on order (red hatched area) and currently only one tile 25 x 25 km has been imaged in Area 4 (see map) . This tile has a cloud score > 20%.*
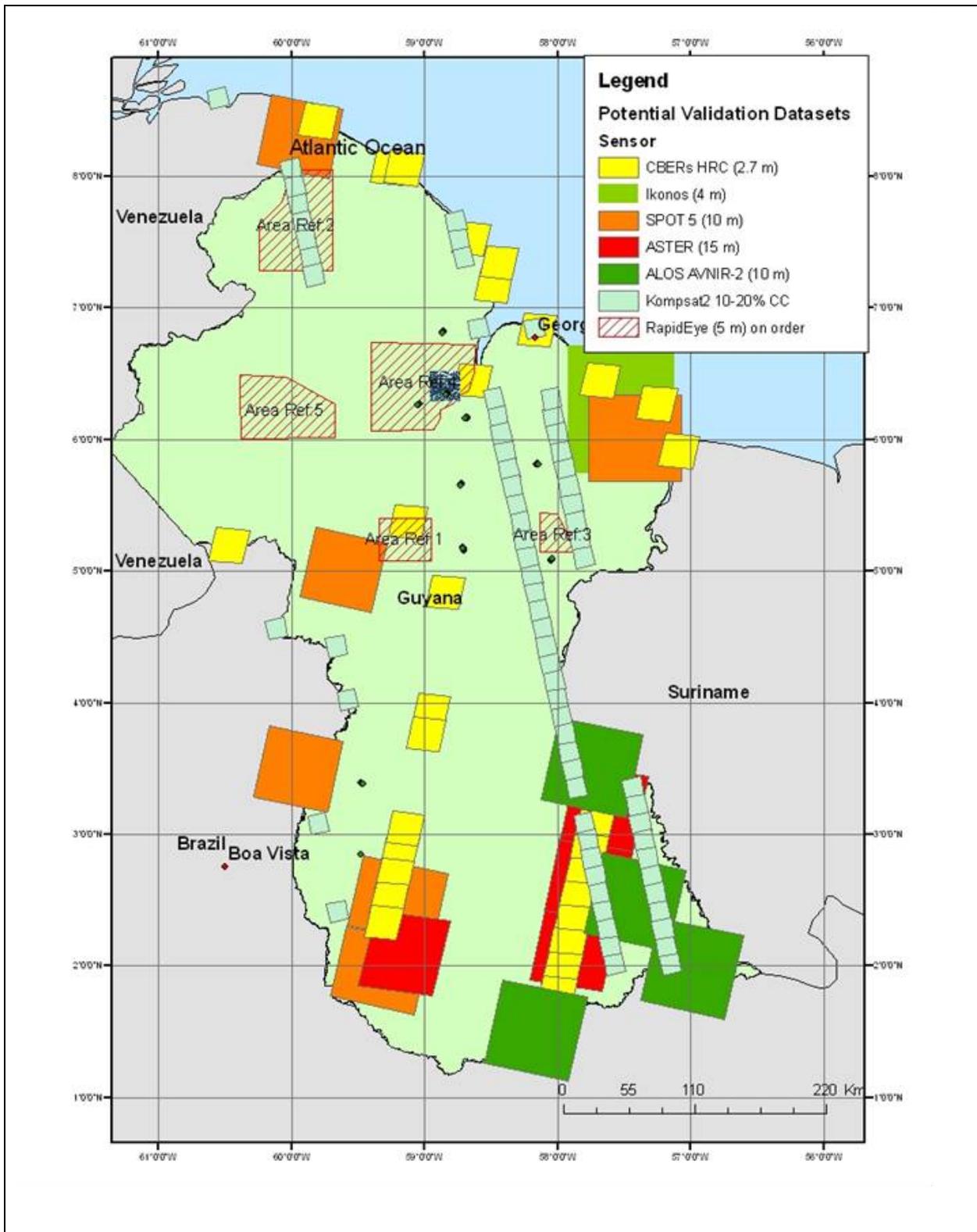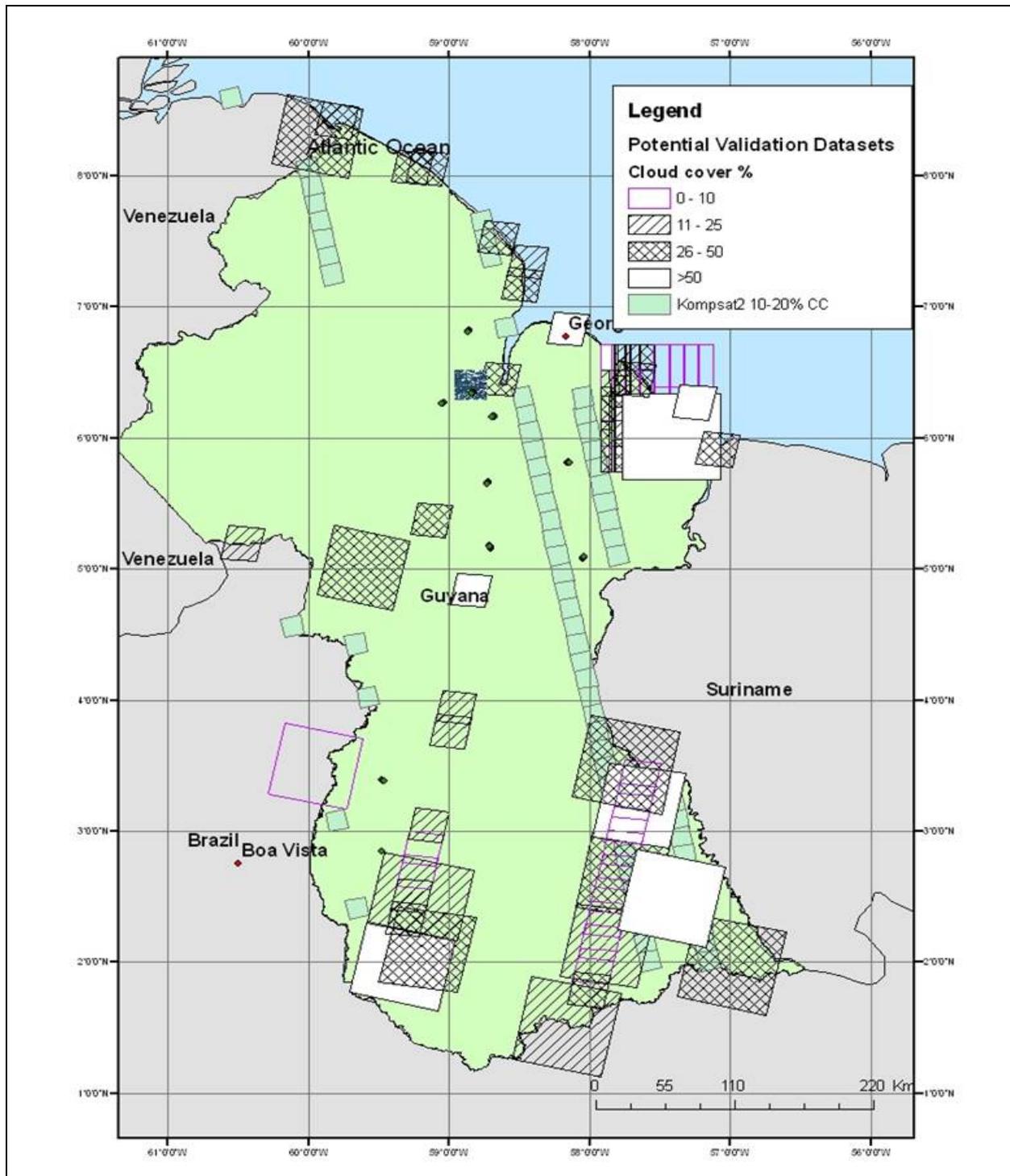
*Due to the lack of data it is unlikely that individual error margins can be assigned to each period. Given this limitation and the concentrated but fragmented nature of the change it would seem prudent to expend efforts on tasking high resolution coverage over the hotspot areas and make greater use of ground inspections.*

**DNV:** *An accuracy assessment is being carried out by Durham University.*

**Comment 15:**

*Section 9: Interim measures: Deforestation indicator: We suggest the reference measure 0.3 % for the deforestation indicator is deleted in table 9.1, as this figure only served as a "mean" estimate based on older sources. Indicatively, the new figure for historical mean annual deforestation can be included here.*

*RP: In Table 10.1 the historic deforestation figures have replaced with the current estimates and duly footnoted.*

*DNV: IMR has been updated and the response is deemed satisfactory*

**Comment 16:**

*Degradation indicator "Intact Forest Landscape": The list of rules in section 9.3. is unclear. Are these areas included in the IFL or excluded? The headings seem to indicate they are included, but this seems inconsistent with the IFL definition. According to section 9.1. the extent of IFL has been determined in the 2009 benchmark map and again at end of September 2009. Yet, table 9.1 provides no information on the change between these two points in time.*

*RP: This section has been updated and further explanation is provided. In the text periods that the IFL was produced was incorrectly stated as 2009 and 2010. The IFL was only generated for 2010 (Year 1) period. It is from this point onwards that IFL is compared.*

*DNV: The RP has been requested to further discuss the definition of the IFL and to include all the information regarding its concept and definition. This is CL 6.*

**Comment 17:**

*Degradation Indicator "Indirect effect of new infrastructure": Given the significance of this indicator in calculating the performance based payments, it seems obvious that this is an area where moving quickly beyond the default rule (50% of carbon loss in 500 meter buffer) should be a high priority. For the purposes of evaluating the appropriateness of the interim indicator, more information on the following aspects would be very useful:*

*•To what extent does the preliminary degradation analysis that has been performed support the 500 meter buffer/"impact zone" around infrastructure? Is there a basis for revision of the width?*

*•Is it possible to derive historical trends for the area impacted by the new infrastructure from the imagery you have available? If so, we would strongly encourage you to undertake an exercise to establish such historical trends as this would be very useful input to a possible review of this interim indicator.*

*RP: We do believe that there is a basis for the revision of the impact zone. From a remote sensing perspective, the degradation is difficult to detect and map reliably – owing to a number of factors including resolution of imagery and the discontinuous nature of*

*deforestation in Guyana.    The limited availability of high resolution imagery makes it difficult to measure the impact of degradation from remote sensing.*

*It is felt that current reported amount based on the default buffer appears significantly larger than what actually prevails.*

*It is recommended that this indicator on degradation be delayed until the MRVS is in place and for payments to not be conditioned on this indicator until better information is available.*

***DNV:*** *The verification team deems that this response is satisfactory. It further deems that the 500 m buffer should be kept until a MRVS system is in place, as there is no evidence that this proxy leads to an overestimation on degradation.*

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**Comment by**: USAID/Guyana, US Forest Service (USFS)

☐ NGO ☐ Party ☒ Other Stakeholders

**Sent on:** 6 December 2010

**Subject**: USFS Technical Feedback to the GFC on Poyry Remote Sensing Report

**Comment 1**:

*Although the appropriateness of the classification methods used is not necessarily questioned, the references (Story and Congalton, 1986; Stehman and Czaplewski, 1998; Stehman, 1999; Stehman, 2001) are quite old for a discipline that has experienced rapid development and maturation in recent years.  Stehman, for example, has multiple more recent publications on accuracy assessment.  In addition, Stehman provides an excellent review of the current status of accuracy assessment methods in McRoberts et al. (2010).*

***RP:*** *No response.*

***DNV:*** *The verification team has raised* CL 5 *asking the RP to discuss the uncertainty of the estimates, and to do so using recent publications in the mentioned area.*

**Comment 2**:

*The results of manual interpretation, as opposed to automated computer-based classification, are subject to additional uncertainty as a result of interpreter-to-interpreter inconsistency. Was this factor assessed?*

***RP:*** *The process was designed so that an operator would assess the change in a 10 x 10 km tile . Over 90% of the change was digitised manually due to high cloud cover. Approximately 50% of these squares were revisited by another operator to confirm, the change and change type and also the delineation of the change. A flag column was introduced to identify areas of disagreement that required review.*

*Unfortunately, the timelines enforced for the work meant that not every tile was revisited by a second operator. The operators used have conducted similar change assessments and we are confident that the training and examples provided enabled consistency between operators.*

*DNV: The verification team has verified that these measures were in place. The verification team has raised a* FAR 2 *for the improvement of QA/QC measures.*

**Comment 3**:

*The report states (page 47) that "the manual method involved dividing Guyana into a series of 10 x 10 km tiles that were then inspected sequentially for change." Areas this size include very large numbers of pixels. Were the change assessments within these tiles made on a pixel-by-pixel basis, a sample of pixels, or an overall basis such as a simple visual scan of the two interpreted areas?*

*RP: Each tile was broken into four 5 x 5 quadrants, so the assessment unit was at this level. The interpretation was conducted at the quadrant level with the user able to zoom in or out as required to identify and map change.*

*DNV: The verification team verified that the interpretation was done in 5x5 quadrants.*

**Comment 4**:

*The total forested area was estimated as approximately 18.40 million ha with "an indicative accuracy of ~91%" (Summary, page iv; page 45). What is "an indicative accuracy"? How is it calculated?*

*RP: We have changed this and used the method that you provided. We have referenced your work and appreciate the worked example*

*DNV: IMR has been updated and the response is deemed satisfactory*

**Comment 5**:

*The classification was based on the relationship between forest canopy cover and the Enhanced Vegetation Index (EVI). That relationship was apparently based on data for 15 transects with as few as three measurements per transect. How many data points were used to develop the relationship? How representative is the sample? How sensitive are interim measure area estimates to changes in the EVI threshold value?*

*RP: The EVI values were used to guide the classification and will replace the word relationship as it is a bit misleading. We decided to select the threshold based on values between 0.5 to 0.6. In total 18 sample points were assessed and also we used SPOT/ IKONOS and 100 m JERS-1 radar data to assist in identifying the non-forest and the forest transition zone. Lastly some of the national biomass dataset (111 plots) that had been sampled in Savannah forest were (12 plots) were used to check the results. These plots were located in the south of Guyana. Scenes where no ground measurements were taken were normalised using the image overlap based on the Pseudo Invariant Features (PIFs) method. The objective was to perform a relative calibration to adjacent scenes.*
*The non forest mapping results were manually assessed using the same 10 x 10 km tile approach to QC the results.*

*The forest and non-forest QC results indicate that classification accuracy is quite high. Additional field work would be valuable in validating and refining these estimates. As is*

*difficult based on these results to say a specific EVI value represents an exact forest cover percent value.*

*The proposed independent accuracy assessment will also provide valuable feedback that will assist in directing future improvement efforts.*

*DNV: The verification team has raised* CL 1 *requesting the RP to include more information regarding the use of the EVI for the definition of forest/non-forest areas. An independent accuracy assessment is being carried out by Durham University; The verification team has requested as* FAR 5 *to discuss these results in the IMR once they are submitted.*

**Comment 6**:

*Tables 8.1 and 8.2 (pages 64-65) report estimates of total forest areas and estimates of forest change by category. However, no estimates of the uncertainty in the form of confidence intervals are reported for these forest and forest change estimates. Such estimates of uncertainty are crucial to understanding and interpreting the basic estimates. In particular, the estimates of deforestation rates are all less than 0.06%. These are very small; are they statistically significantly different than 0? Are these estimates of change of the same order of magnitude as the uncertainty associated with them? This issue was raised in our initial comments and questions to Poyry before the project began. Note that this issue of uncertainty assessment is somewhat different than, although related to, map accuracy assessment. Several approaches to estimating the precision and bias are possible including a method based on marginals documented by Card (1982).*

*RP: Thee comments are acknowledge. As part of the mapping process we included an internal QC component. We had sufficient time before the reporting deadline to assess the accuracy of the non forest and forest mapping. However, a rigorous assessment of the uncertainty in the change mapping has not been attempted.*

*The intention is that this work will be completed by the independent team and their findings and recommendations will be used as a basis to update the report.*

*We would be grateful if you could share the publications that you have referenced.*

*DNV: The verification team has raised* CL 5 *asking the RP to discuss the uncertainty of the estimates, and to do so using recent publications in the mentioned area. An independent accuracy assessment is being carried out by Durham University; The verification team has requested as* FAR 5 *to discuss these results in the IMR once they are submitted.*

# 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 and Verification System (MRVS) - Interim Measures Report*, Versions of 7 January 2011 and 16 March 2011

/2/    Guyana Forestry Commission: *Geodatabase with all raw and processed datasets*, January 2010

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/6/    Guyana Forestry Commission: *Data Base of wood harvesting declarations of wood extraction activities in lands classified as Amerindian or Private Property– 1 October 2009 to 30 September 2010 – Year 1*, 10 February 2011

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/10/   Guyana Forestry Commission: Manage UOM conversion factors, 9 February 2011

/11/   Guyana Forestry Commission*: Annual production and export volumes of timber and plywood for years 2000-2010*

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/13/   Guyana Forestry Commission: *Forestry in Guyana - Quarterly Market Report - 2003/2*

/14/   Guyana Forestry Commission: *Forestry in Guyana - Quarterly Market Report - 2003/3*

/15/   Guyana Forestry Commission: *Forestry in Guyana - Quarterly Market Report - 2003/4 and 2003 Summary Report*

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/20/ Guyana Forestry Commission: *Forest sector information report – Annual Review January – December 2008*

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

/39/ James Singh, Commissioner of Forests - GFC

/40/ Tasreef Khan, Deputy Commissioner of Forests - GFC

/41/ Predeepa Bholanath, Head, PDD-GFC

/42/ Alandia Warde, Monitoring Inspector, Supervisor Mabura Fores station - GFC

/43/ SonyaReece, Assitant Commissioner of Forests - GFC

/44/ Godfrey Marshall, Director – Forestry Training Centre

/45/ Nasheta Dewnath, Programme Officer – REDD Section

/46/ Chetram Ramgobind, Economist - GFC

/47/ Pete Watt, Consultant – Pöyry management consulting

/48/    Nelson Gapare, Consultant – Pöyry management consulting

/49/    Andrew Meredith, Consultant – Pöyry management consulting

/50/    Haimwant Persuaud, Resource Information Officer - GFC

/51/    Darshini Rampersaud, Assistant Commissioner of Forests - GFC

/52/    Quacy Bremner, Assistant Commissioner of Forests - GFC


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/60/    Voluntary Carbon Standard Association: *REDD Methodology Module REDD Methodology Framework (REDD-MF),* Approved VCS Methodology VM0007 Version 1.0

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*Inputs from stakeholders*

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/81/ Vemund Olsen- vemund@rainforest.no - Emails from 22 February 2011 and 16 February 2010

/82/ John Palmer - jrpalmer2005@waitrose.com – Email to the Government of Norway

/83/ USAID/Guyana, US Forest Service (USFS) - *USFS Technical Feedback to the GFC on Poyry Remote Sensing Report*

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# APPENDIX A

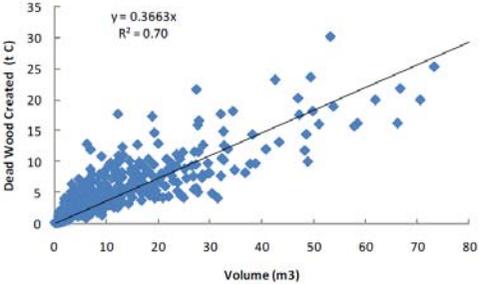## CORRECTIVE ACTION REQUESTS, CLARIFICATION REQUESTS AND FORWARD ACTION REQUESTS

DET NORSKE VERITAS

## Corrective action requests

| CAR ID | Corrective action request | Response by Responsible Party of the assertions | DNV's assessment of response by Responsible Party of the assertions |
|---|---|---|---|
| CAR 1 | <u>Indicator 3</u><br>According to the Government of Norway's clarification of 15 February 2011 /64/ "the extracted volume indicator should be as related as possible to actual biomass removals from the forest". This implies that the extracted volume has to be related to biomass removed from the aboveground carbon pool.<br>The GFC has reported the total volume declared for the wood removals in the State Forest and the Amerindian, Private Properties, plus the wood removals linked to procedural breaches and illegal logging /1/. The total volume declared is always expressed in CBM of wood removed. However, during the site visit, DNV checked that in the case of logs the CBM declared are not the actual CBM removed, but the commercial fraction of the CBM removed (i.e. this is the fraction of the log which will be used for industrial process). The fraction considered as commercial is 78.52% of an actual CBM. This means that not all the volume removed from the Aboveground carbon stock is considered in these calculations, and this could tend to an underestimation of the biomass removals. | **Summary Position: Accepted**<br><br>The GFC indicated to DNV that in accordance with the Forest Legislation, production for the purpose of royalty is computed using what is termed a 'hoppus/quarter girth' measurement which assumes a factor of 78.25% of the true volume. Since this is a legislative requirement, the GFC is legally required to report on this production level. GFC's data has been so prepared and reported. The GFC has taken note of DNV's clarification with Norway as it relates to reporting of extracted volume.<br><br>The GFC will gross up the log and lumber volume to the effect of true volume reporting for logs and a doubling of the lumber volume to reflect the extracted amount prior to declaration.<br><br>Table with production breakdown provided for both historic and current year.<br><br>Changes made on pages vi, and Section 10.3.3 | The verification team checked the volume calculations and the interim measures report and confirms that have been corrected considering the following equation:<br>$$V_{Declared} = V_{real} \cdot 0.7825$$<br>Therefore, in order to calculate the real volume out of the declared volume the calculation would be:<br>$$V_{real} = \frac{V_{Declared}}{0.7825} = 1.278 \cdot V_{Declared}$$<br><br>CAR1 is closed. |

| CAR ID | Corrective action request | Response by Responsible Party of the assertions | DNV's assessment of response by Responsible Party of the assertions |
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| | Furthermore, during the site visit it was checked that in the case of the produce Lumber, the CBM declared are the CBM of sawnwood extracted from the forest. The GFC considers that 50% of the felled trees remain on-stand; hence, this would represent a removal of the aboveground pool. *In order to make an accurate estimate of the biomass extracted from the aboveground carbon pool, as stated by the clarification made by the Government of Norway, PP is requested to make the needed changes in the calculations and consider the total volume removed. This shall be done consistently for Year 1 and the reference period 2003-2008.* | | |
| CAR 2 | Indicator 3 According to the provisions made for Indicator 3 in the JCN /51/ "Increases in total extracted volume (as compared to mean volume 2003 – 2008) will be accounted as increased forest carbon emissions…". Therefore, if the extracted volume is increased over the mean volume 2003 – 2008, the extracted volume would have to be extracted in terms of carbon emissions. The RP has considered the extracted volume in CBM in order to make this comparison between Year 1 and the reference period. Following the provisions of the JCN, RP | **Summary Position: Proposal to change from a CAR to a FAR owing to work currently ongoing to establish this and which will be ready by end of 2011.** The extracted volume when compared to the mean volume of 2003-2008 is lower (even with the corrective action fully taken on board as required by DNV and as accepted by GFC in CAR 1) and hence, there is not an increase as stated by DNV. It is our understanding that the MRVS would address the carbon impacts and the work currently being conducted by Winrock International seeks to do just this and will be ready by end of 2011. Thus, the | Following the clarifications provided by the Government of Norway /76/, considering that the mentioned indicator is not critical as the extracted volume in Year 1 is lower in relation to the reference period, The verification team accepts to close this CAR and to open a FAR recommending this to be addressed in the next verification. **CAR2 is closed.** FAR 6 is open. |

| CAR ID | Corrective action request | Response by Responsible Party of the assertions | DNV's assessment of response by Responsible Party of the assertions |
|---|---|---|---|
| | is requested to make this comparison in terms of carbon units; and is recommended to add to this figure the collateral damage on the remnant forest in terms of carbon units. Besides, as the extracted volume is an interim indicator of degradation according to the JCN /51/, it would be reasonable to consider this in terms of carbon units. | reporting of a possible increase in carbon terms is better positioned as a FAR and to be taken into account for the next reporting period. The GFC would therefore request the removal of this CAR and put as a FAR.

Direct contact with Winrock International (mail forwarded to Govt. of Norway) also concludes that that there is no established scientific source that can guide on the biomass to extracted timber volume relationship.

Additionally, the segregated approach of addressing collateral damage separate to total extracted volume is not in keeping with the requirements of the JCN. The JCN requires for total extracted volume increases to be reported in forest carbon emissions. The Indicator requires that "if the extracted volume increased over the mean volume .."

In the period under question there was no total volume increase and thus it would be incorrect of the GFC to report in carbon units. | |
| CAR 3 | Indicator 3
According to the provisions made for Indicator 3 in the JCN /51/ "In addition to the harvested volume, a default expansion factor (to be established) shall | **Summary Position: Proposal to change from a CAR to a FAR owing to work currently ongoing to establish this and will be ready at the end of 2011.** | The verification team has checked the response of the RP and no response has been provided to the issues that were pointed out. RP is requested to do so:
- 25% collateral damage: The reference |

| CAR ID | Corrective action request | Response by Responsible Party of the assertions | DNV's assessment of response by Responsible Party of the assertions |
|---|---|---|---|
| | 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". Therefore, the wood removals shall be increased by a factor that takes into account the carbon loss due to collateral damage. <br><br> The GFC has sourced the applied logging damage factor from Sist (2000) /23/ who relates that generally for Latin America a logging intensity of 5-7 trees/hectare (equivalent to volume of 30-50m$^3$) leads to damage of 25-40% of the original population of trees (in terms of trees injured or killed). Based on this the GFC has considered a 25% as logging damage factor considering the current logging intensity (at a maximum of 10 m$^3$/ha). However, this reference states the amount of <u>the original population of trees which would be damaged after logging</u>, not the additional trees that would be damaged due to the logging operations. Furthermore, a logging factor of 25% would not be consistent with the logging damage factors /66//67//59/ commonly used in forest carbon accounting, which show higher values for similar logging intensities. The referenced logging damage factors make reference to the emissions that arise from the non-commercial portion of the felled tree (the | Winrock International is currently in the process of scientifically establishing a rate of logging damage to be applied to the MRVS aspect of forest degradation. It was the joint understanding by all relevant parties at the start of the process that this is a first step to the development of a full MRVS for Guyana. Issues such as total forest carbon stock per forest strata, forest carbon stock per extracted stem, and the relationship between extracted volume and damage to original population are being established by work that is being done by Winrock International at this present moment. Winrock International has been directly contacted (telephone conversation with Dr. Sandra Brown on Thursday 3$^{rd}$ March, 2011) and the expert opinion was made that the basis of Study /66/ is very divergent from the purpose that it is being proposed for by DNV in reporting on this indicator. <br><br> Whilst this is ongoing and will be completed by end of 2011, the GFC has applied an expansion factor of 25% for collateral damage and has applied this to extracted volume. Based on the evidence that is provided hereunder, DNV's recommendation for GFC to increase the level of collateral damage to a higher figure, at this time poses some difficulty for appropriate and relevant application for | used states that this would be the amount of <u>the original population of trees which would be damaged after logging</u>, not the additional trees that would be damaged due to the logging operations. Therefore, it seems that the 25% figure shall be applied to the whole population (harvested + remnant) and not to the extracted volume. <br> - <u>Logging intensity of 10 m$^3$/ha</u>. The verification team has sourced from the code of practice /68/ a logging intensity of 20 m$^3$/ha applied to all forestry concessions. This figure is not only the maximum as stated by the RP, but it is used for the estimation of the quota imposed to each concession as explained by the RP during the on-site assessment /38/. Hence, it can be deemed that the 20 m$^3$/ha logging intensity could be applied and would give conservative estimates. <br><br> However, following the clarifications provided by the Government of Norway /76/, considering that the mentioned indicator is not critical as the extracted volume in Year 1 is lower in relation to the reference period, The verification team accepts closing this CAR and to open a FAR recommending this to be addressed in the next verification. |

| CAR ID | Corrective action request | Response by Responsible Party of the assertions | DNV's assessment of response by Responsible Party of the assertions |
|---|---|---|---|
| | branches and stump) and trees incidentally killed during tree felling /59/, therefore are more complete from the point of view of the logging effects on the aboveground carbon pool.<br><br><br><br>**Figure 2. Relationship between the extracted volume and the dead wood created according to Pearson et al. /66/**<br><br>Hence, the RP is requested to modify the applied logging factor and to apply a logging damage factor accepted by the applicable criteria /59/.<br><br>On the other hand, the RP has assumed a logging intensity of 10 m$^3$/ha in order to establish the logging damage factor. However, this value is not consistent with the code of practice /68/ which states a logging intensity of 20 m$^3$/ha applied to SFPs, which represents 92% of the volume /38/. Besides this logging intensity is used for the determination of quotas at a concession level considering | the reasons outlined below and above:<br><br>**Question of Relevance**<br>DNV is alluding to other sources which use a higher logging damage factor e.g. Indonesia, etc. It is imperative that it be noted, that the type and structure of forest management in Guyana as compares to the countries studied in the quoted sources by DNV are significantly divergent and one may conclude to be unsuitable for Guyana's national context.<br><br>**Question of Double Counting**<br>Additionally, it should be noted that logging infrastructure is directly reported under another indicator in the JCN also verified by DNV. Indicator entitled "Carbon Loss as Indirect Effect of New Infrastructure" addresses the infrastructure aspect of logging damage from a degradation perspective.<br><br>To include logging damage caused by infrastructure in two separate degradation indicators, will be misleading and will be an incorrect application of the degradation impact measurements from forestry activities.<br><br>**Question of Appropriateness of Approaches Applied and Units of Measure** | **CAR3 is closed.**<br><br>FAR 6 is open. |

| CAR ID | Corrective action request | Response by Responsible Party of the assertions | DNV's assessment of response by Responsible Party of the assertions |
|---|---|---|---|
| | the whole concession area, yet the actual logging intensity practiced punctually would be higher. PP is requested to use a real and a conservative logging intensity and provide supporting evidence while doing so. | Further, the sources used as a basis for disproving the GFC's estimate of 25% as collateral damage are not appropriate for the reference that DNV is using it for. The issue in DNV's application of references is that none of the references has been done in similar forest type, where the same forest techniques are applied, where the extraction rate is the same, and where the measure of impact is volume of timber/trees.<br><br>The rate of collateral damage is not only dependent on the number of gaps created, but the size of the gaps, as well as the size of the tree canopy of the specific tree being felled. Additionally, it is also dependent on the number of skid trails established and whether reduced impact logging was being practiced or conventional logging.<br><br>The main study that was used /66/ cannot be applied to the Guyana situation for the following main reasons:<br>• The Study reports on carbon stock impacts and not volume or production level impacts. As such, it is not applicable to be forest management indicator that addresses forest extracted volume as the base information source.<br>• The studies were conducted in areas where conventional logging was practiced | |

| CAR ID | Corrective action request | Response by Responsible Party of the assertions | DNV's assessment of response by Responsible Party of the assertions |
|---|---|---|---|
| | | and not reduced impact logging as is largely the case in Guyana<br>• The studies were not conducted in forests of similar dynamics like Guyana forests.<br>• The studies were conducted in areas where the size of skid trails, logging blocks and roads all vary significantly for that of Guyana.<br>• There are significant differences in the area of cubic meter extracted in cases such as Indonesia, Brazil (used in the study) and that which prevails in Guyana.<br>   The second study quoted to justify an alternative percentage to 25% is that is /59/. For a number of similar reasons like those alluded to above particularly the conducting of the assessment in peat swamp forest , the study is not applicable to the Guyana context as the main variables applied in the methodology are inconsistent with the local forest type and dynamics.<br><br>DNV expresses that the total extraction of 20m3/ha is applied to SFPs and takes this to mean that this is what forest operators extract in practice – at this maximum level. This assumption is not reflective of the situation practically in Guyana where the extraction rate is significantly lower than the maximum allowable cut. The Code of Practice sets a maximum allowable cut based on the precautionary principle of | |

| CAR ID | Corrective action request | Response by Responsible Party of the assertions | DNV's assessment of response by Responsible Party of the assertions |
|---|---|---|---|
| | | 20/m3 per hectare over a 60 year cutting cycle.<br><br>GFC disagrees with DNV's assertion that the Commission has reported that SFPs account for a 92% share of production. GFC would like to indicate that this is not the case as reported by DNV. In actuality, the percentage of SFP share of total production is notably different from the DNV reported percentage.<br><br>Email by DNV to GFC dated Thursday March 10th, 2011 approves for this to be a FAR.<br><br>Insertion made in Section 10.3.3 regarding the shortcoming of this application and the intention to address this matter for upcoming assessments. | |
| CAR 4 | During the on-site assessment The verification team checked the database on illegal logging and on procedural breaches /3//4/, and performed a spot check of records (9 illegal logging records and 8 procedural breaches) comparing the recorded values with the actual values stated in the removal permits or in a detention / seizure report. During this spot-check, the verification team found some minor inconsistencies (i.e. less than 5 % and 1% of material | **Summary Position: Accepted**<br><br>It should be noted that this finding contradicts the definition and guidance of what should be classified as a CAR. As admitted by DNV, there were few and minor inconsistencies and do not qualify as a CAR as they are not significant. i.e.<br><br>(i.e. less than 5 % and 1% of material discrepancy in the illegal logging and the procedural breaches respectively). | The verification team checked the illegal logging and procedural breaches volume extraction and confirmed that errors have been corrected.<br><br>**CAR4 is closed.** |

| CAR ID | Corrective action request | Response by Responsible Party of the assertions | DNV's assessment of response by Responsible Party of the assertions |
|---|---|---|---|
| | discrepancy in the illegal logging and the procedural breaches respectively). Furthermore, some errors were detected in the database calculations. *Hence, RP is requested to make the necessary corrections in the database and to update the value reported in the IMR.* | In the interest of comprehensiveness, the GFC will update the relevant database to include the minor change in the procedural database as being requested by DNV of 72m$^3$.<br><br>Production breakdown tables for historic and current year periods. Changes made in Section 10.3.4. | |
| CAR 5 | Indicator 2a<br>The methodology applied by the RP to prepare the Year 1 IFL layer appears logically consistent with criteria Potapov *et al.* /69/, the definition of IFL /76/ and the JCN /51/; however, three issues were found in further review following the onsite visit:<br>(a) the exception of exclusion of timber production areas which is not in line with the definition of IFL as it is logging at an industrial scale; at low intensity though;<br>(b) the need for at least 2 km wide corridors or appendages to and from areas meeting appropriate conditions (in a number of examples, appendages are but 30, 230, 243, 400, and 520 meters);<br>(c) Cleanup of the island polygons which would fail either the 10km | **Summary Position: Accepted**<br>NOTE: IMR Section 10.3.1 updated accordingly.<br><br>In accordance with IPCC GPG, national circumstances need to be considered and in that regard we provide the following response:<br><br>RESPONSE TO POINT (a)<br>The GFC notes the point made in the CAR and will implement the action as advised. The GFC would like to outline however, for purposes of record and reference, the underlying reasons behind exercising IFL in the manner applied in IMR version January 2011:<br><br>1. Due to the nature of forestry and agricultural practices in Guyana, as acknowledged by the verifiers in point | The verification team has checked the modified IMR and the modified analysis. The verification team confirmed that the raised issues (a), (b) and (c) have been corrected, and that the result is consistent with that reported in the IMR.<br><br>**CAR5 is closed.**<br><br><br>The verification team recommends for future monitoring events the inclusion of (c) in the IFL tool applied for the analysis. Furthermore, for future improvements of the initiative The verification team recommends that in future monitoring events the uncertainty of the relevant estimator is also determined.<br><br>FAR 8 and FAR 10 is open. |

| CAR ID | Corrective action request | Response by Responsible Party of the assertions | DNV's assessment of response by Responsible Party of the assertions |
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| | size or 2 km width test.<br>The timber production areas exclusion is a valid concern of public stakeholders, who consider that the Year 1 deforestation polygons buffered and excluded by the GFC team's model did not exclude existing timber production areas /78/.<br>*PP is requested to address all three issues pointed out which are not consistent with the criteria pointed out in section 4.1.b.* | (a), there is no industrial scale clear-felling to bring into question the validity of the IFL. Therefore the inclusion of timber production areas under sustainable management in the IFL is consistent with national circumstances and land use practices. It is also noted that the CAR is presented in isolation to other components of the Interim Measures Report - for example the forest management regime.<br>2. All forestry operations are managed sustainably and audited by GFC to ensure compliance with the harvesting code of practice. This activity does not result in deforestation - harvesting is therefore treated as a background influence.<br>3. It is also noted that the verification criteria (page 9) does not speak to the definition of IFL. This would be a useful addition.<br><br>RESPONSE TO POINT (b)<br>4. Point noted and corrective action has been taken. The IFL has been updated taking this recommendation on board.<br><br><br>RESPONSE TO POINT (c)<br>This point is noted. It is however, unclear whether these errors are systematic or | |

| CAR ID | Corrective action request | Response by Responsible Party of the assertions | DNV's assessment of response by Responsible Party of the assertions |
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|  |  | isolated cases. As such GFC proposes that this be reviewed after completion of the accuracy assessment after which corrective can be taken as part of the improvement strategy and with better understanding of the magnitude of the issue.<br><br>Shapefiles attached with revision. |  |
| CAR 6 | Indicator 2b<br>During the on-site assessment the verification team repeated the described methodology with the latest versions of the estimated the area of degradation to be 93 853 ha; an area some 20 percent higher than the GFC estimate. A review of input data and methods showed that the RP calculated its reported estimate with incomplete GIS input data.<br>PP is requested to correct the assertion reported in the IMR /1/, including the real assertion estimated through the application of the validated methodology. | **Summary Position: Accepted**<br><br>Yes this is acknowledged and the amendment will be made in the report. The error arose from re-coding forest change from a previous period to year 1 during the QC process. The spatial analysis had already been complete and was not updated to reflect this change.<br>Corrective action has been taken to resolve this oversight and included as part of QA/QC measures to be implemented in the improvement strategy<br><br>Changes made on pages vi, 85 and 92.<br><br>New Shapefiles sent to justify 92,413ha. | The verification team has checked the shapefiles provided, and the final area of degradation would be 92 413 ha. The reason of the deviation between the value obtained during the on-site assessment (93 853 ha) and the final value reported is due to the inclusion of Non-forest areas and areas outside the Guyana border in the former calculation.<br>Hence, the verification team deems the figure correct.<br><br>**CAR6 is closed.**<br><br>Furthermore, for future improvements of the initiative the verification team recommends that in future monitoring events the uncertainty of the relevant estimator is also determined.<br><br>FAR 10 is open. |

| CAR ID | Corrective action request | Response by Responsible Party of the assertions | DNV's assessment of response by Responsible Party of the assertions |
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| CAR 7 | Indicator 5<br>In agreement with the reported assertions, the total area found to have been burned was 33 694 ha. However, the RP has used 19.8 years as length of the period, while the total number of years is slightly lower (i.e. 19.75 years). This would lead to a higher number of ha annually burned (i.e.1 706 ha/year).<br>PP is requested to make the necessary changes in the IMR considering 19.75 years for their calculation. | **Summary Position: Accepted**<br><br>NOTE: All reference to the 1700ha figure and changed to reflect a time period of 19.75 years. A new spreadsheet is also provided<br><br>Corrections have been made using 19.75 years and the area is now 1 706 compared to the reported 1 700ha.<br>In any case, the negligible difference of 6 ha results from rounding off and represents 0.3% with 1700 ha as IMR reported vs. 1706 ha.<br>GFC believes that the this issue being stated under a Corrective Action Request is not consistent with the definition of a CAR (page 14):<br>A corrective action request (CAR) is issued, where:<br>• Non conformance if the evidence provided to prove conformity is insufficient<br>• Mistakes that have been made in applying assumptions, data or calculations which could have SIGNIFICANT INFLUENCE on the results.<br><br>In any case, the negligible difference of 6 ha results from rounding off and represents 0.3% with 1700 ha as IMR reported vs. 1706 ha. | The verification team checked the IMR and it has been updated with the correct figure of 1706 ha/year of hectares burned per year.<br><br>**CAR7 is closed.**<br><br>Furthermore, for future improvement of the initiative, the verification team will open a FAR recommending the consideration of uncertainty of the estimate for the relevant indicator.<br><br>FAR 10 is open. |

| CAR ID | Corrective action request | Response by Responsible Party of the assertions | DNV's assessment of response by Responsible Party of the assertions |
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| | | Change made in Section 10.3.5. Spreadsheet attached. | |

## Clarification requests

| CL ID | Clarification Request | Response by Responsible Party of the assertions | DNV's assessment of response by Responsible Party of the assertions |
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| CL 1 | Some questions remain to be clarified regarding: a) the viability of using single date EVI data as a proxy for sufficient crown cover for the term of the project, as a recent study suggests that EVI data are susceptible to seasonal, interannual, and interannual variabilities (Brando *et al*, 2010) /70/ and subject to error and uncertainty (Glenn, 2008) /71/; and b) while a spherical densiometer is a tool used for assessing crown cover, Korhonen (2006) /72/ writes that its measurements are sensitive to forest maturity and how and where the device is used in the field. The GFC team carried out 15 densiometer transects in forested locales to derive a densiometer threshold in relation to EVI, but little detailed information on this aspect of data collection was noted. These issues will be addressed as a clarification request. *PP is requested to include additional information on the methodology applied in the IMR, to discuss which references were used for the design of the methodology, and to include an assessment of whether the method used has given accurate estimates considering the conditions of Guyana.* | NOTE: Text updated in the IMR Sections 5.4, and 6.1<br><br>1. Reference to the EVI is being presented in a manner that does not represent the situation on the ground and responses given to the verification team during their site visit.<br><br>2. It is also noted the verifiers have not taken into consideration the RP's communiqué on the limited use of the Enhance Vegetation Index (EVI). The EVI was used only in part as one of various components to derive the end product.<br><br>3. The use of EVI is not in the critical path of the decision making process during classification because there is significant manual intervention during classification.<br><br>4. Note that it is stated that more than 90% of satellite imagery used was manually interpreted acknowledging the limitations, including seasonal, and inter-annual variability.<br><br>5. The consistency check conducted by | The verification team has checked the revised IMR and confirms that it has been updated including the reference to the limitations of the method as stated by Brando *et al* (2010).<br>However, no additional information of the reference used to support the method applied is given.<br>Besides, the RP states in the IMR and in their response that the EVI derived forest/non-forest map was input into a GIS, where it was systematically, using a 10 x 10 km grid, evaluated by an operator using all available 1990 datasets. The forest/non-forest boundary was adjusted if the operator's interpretation of the available dataset differed from the EVI derived boundary. Care was taken to separate change events post 1990 from non forest areas.<br>Although the verification team deems that the approach followed does not follow the applicable criteria and that it might cause some errors that may influence the results, the verification team is not able to assess its magnitude and the possible material discrepancy. The independent accuracy assessment which is being performed has within its tasks to assess the 1990 Forest/Non-forest map and the Year 1 |

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| | | DNV as part of the verification exercise (see pg 11 of DNV report) indicated that the forest / non forest boundary was correctly identified. | Forest/Non-forest map, so any major errors above that stated by the applicable criteria would probably be identified by this assessment. |
| | | COMMENT | Hence, the verification team closes this CL and opens a FAR recommending for future verification events to provide the accuracy assessment previous to the end of the verification. Furthermore, due to the limitations in the use of EVI, RP is recommended to seek alternative methods. |
| | | The GFC team acknowledges the limitations in the use of EVI and densiometer data for identifying the exact boundaries of sufficient crown cover (>30% forest cover).  The methodology was only used as a **guide** to initially define the forest/non-forest boundary.  A systematic manual review of the boundary for each tile was then performed within the GIS using all available 1990 datasets.  The boundary was adjusted if the operator's interpretation of the available dataset differed from the EVI derived boundary. The results of the accuracy assessment will provide a measure of the effectiveness of this mapping methodology. | CL1 is closed.

FAR 5 is open. |
| | | Points raised in Brando et al acknowledged and incorporated in the IMR. | |
| | | COMMENT | |
| | | The GFC team acknowledges the limitations in the use of EVI and densiometer data for identifying the exact boundaries of sufficient crown cover (>30% forest cover).  The methodology | |

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| | | was only used as a **guide** to initially define the forest/non-forest boundary. A systematic manual review of the boundary for each tile was then performed within the GIS using all available 1990 datasets. The boundary was adjusted if the operator's interpretation of the available dataset differed from the EVI derived boundary. | |
| CL 2 | Comment stakeholder<br>One of the inputs received from the stakeholders /79/ points out that the deforestation assertions reported are not consistent with those reported to the Forest Carbon Partnership Facility.<br><br>PP is requested to include in the IMR an explanation on why there has been such a difference between the gross deforestation assertions and those reported to the Forest Carbon Partnership Facility. | The GFC explained to the DNV team during their verification site visit that the interpretation by John Palmer's/Janette Bulkan's Summary in the comment received is an inaccurate representation of the GFC data presented in its Quick Assessment Report to the Forest Carbon Partnership Facility. During the site visit GFC offered this clarification in detail to DNV – a point which was noted by DNV at that time and an indication that it was understood. This is however not reflected in the results of this matrix and only the stakeholder's views are captures that may leave the impression that they GFC has not previously discussed this matter with DNV. Below, is a summary of what the GFC had reported to DNV in the site visit, on this matter:<br>1. The stakeholder incorrectly interprets the GFC's reported information in its Quick Assessment Report to the FCPF.<br>2. The GFC explained to DNV that | DNV deems that the response provided gives sufficient clarification to the comment given by the stakeholder.<br><br>**CL2 is closed.** |

The embedded deforestation table in the Clarification Request cell:

| Deforestation item | GFC FCPF/R-PIN to R-PP | Poyry-GFC | Poyry-GFC |
|---|---|---|---|
| Period of study | 2007-2008,<br>1 year | 1990-2009,<br>19 years | 2009-2010,<br>1 year |
| 'agriculture' | 21903 | 6679 | 513 |
| Fire-burned areas | nil | 1943 | 32 |
| Logging roads | 7879 | 19298 | 294 |
| Mining | 24428 | 44905 | 9384 |
| Roads and airfields | nil | 2089 | 64 |
| Total deforestation | 54210 | 74914 | 10287 |

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|       |                      | the total report as at 2007-2008 is just that – the **accumulated** total as at 2007/2008 with no benchmarking to any year done. As such, this is the total deforestation reported, that was picked up with images taken over a two year period. 3. The Quick Assessment report of 2007/2008 does not assess 2007/2008, but is an assessment/mapping done at that time period using images at 2007/2008. This therefore means that the assessment conducted during those two year period would have assessed the cumulative effect of deforestation up to that time. 4. The Poyry consultancy of which the 2010 report summarises, conducted assessments by separate time period and sets a benchmark year from which the changes in 2009/2010 was measured, In doing so, there is no accumulating of deforestation totals but there is an annualised accounting of deforestation rates. In actual fact, given a total deforestation at 2007/2008 of 54,210ha and a rate of 74,914ha as at September 30, 2010 then this means that two annual periods may account for the |  |

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| | | difference of approx. 20,000ha which is right on target with the annual estimate of 10,287ha for the current year.<br>Clarification offered in Section 8.1. | |
| CL 3 | Comment stakeholder<br>An input from a stakeholder has been received regarding a possible inconsistency. According to the ITTO's Market information Service (MIS) /81/: "Surging log exports prop up earnings in 2010 The total exports of forest products from Guyana in 2010 were valued at US$49 million, up 7.89% compared to 2009. However, only exports of logs showed a sharp increase of 68.6%, from US$10 million recorded in 2009 to US$17 million in 2010. The total export volume of logs also soared 78.3% compared to 2009."<br><br>*PP is requested to clarify why this source is inconsistent with the reported assertions.* | There is no inconsistency in this statement. Total export value is a measure of the total value of all forest produce.   This is made up of logs, sawnwood, roundwood, etc.<br><br>Thus, the total export value did increase and this was brought about by increase(s) in specific forest products. One of these products was logs but this was not the only produce as another product that contributed to the increase was Roundwood, as an example.<br><br>This CL appears to have been made without full account taken of the total value of what is included in all exports of forest products.   Thus, the total of a measure can increase with one, two, three, etc products increasing, and so on. | The verification team deems that the response provided gives sufficient clarification to the comment given by the stakeholder.<br><br>**CL3 is closed.** |
| CL 4 | Comment stakeholder<br>PP is requested to further explain in the IMR how Indicators 3 and 4 have been determined; this is to explain how extracted volumes are monitored, | The IMR provides the overall framework within which these two indictors are generated.  Pages 90 to 92 outlines the technical and administration processes that are followed in the determination of forest | The verification team checked the latest version of the IMR. The verification team confirms that it has been updated with additional information of how extracted volumes are monitored and how data is |

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| | including how data is collected and recorded, which produce is considered in these calculations, the QA/QC measures in place, etc. | production and illegal logging totals including steps for monitoring, collection, recording, storage and quality assurance.<br><br>The report also outlines that for each step of the process full documentation is available for verification. These were all provided to DNV.<br><br>Nevertheless, the GFC will seek to expand the narrative under this indicator.<br><br>Changes made to Section 10.3.3. | collected, recorded and reported.<br><br>**CL4 is closed.** |
| CL 5 | Comment stakeholder<br>RP is requested include in the IMR a discussion on how the uncertainties in estimates (Forest/Non-forest and forest change) influence the conclusions that are drawn regarding the deforestation figures in the historical periods and for the first reporting period.<br>Furthermore, RP is requested to use the most recent publications on accuracy assessment as recommended by the United States Forestry Service in Comment 1.<br>Furthermore, once the accuracy assessment is delivered, RP is requested to include this in the discussions regarding uncertainty (See FAR 5). | **NOTE:  Refer to Section 9.6 of the IMR**<br><br>1.  Note that it is unusual for the mapping team to undertake its own accuracy assessment hence GFC have contracted Durham University to undertake a full accuracy assessment exercise.<br><br>2.  The simple verification described in the IMR was only 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. This point is made clearly in paragraph 2 on page 69 of the IMR report. | This is the comment received during the official public comment period from one relevant stakeholder:<br>-  Department of Environment (Miljøverndepartementet) – Government of Norway:"In general, we miss a discussion of how the uncertainties in estimates, and the pending valuation exercise, influence the conclusions that are drawn re deforestation figures in the historical periods and for the first reporting period. These conclusions are presented without an error margin, but there are obvious reasons to expect that the error margins could be considerable."<br>Additionally a relevant stakeholder |

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| | | 3. The comments provided by USFS were made after the report was submitted. The papers provided have since been made available and provided to the accuracy assessors.<br><br>4. The independent accuracy assessment is the most appropriate study to provide recommendation and qualified statements on the accuracy of forest/non forest mapping and change detection mapping.<br><br>5. This points made above were all made previously to DNV in their site visit to Guyana. | submitted a comment out of the official public comment period:<br>- United States Forestry Service: "However, no estimates of the uncertainty in the form of confidence intervals are reported for these forest and forest change estimates. Such estimates of uncertainty are crucial to understanding and interpreting the basic estimates."<br><br>As a result, RP is requested to discuss the uncertainty of the estimate in order to address the comments from the listed stakeholders.<br>However, the verification team accepts that this cannot be discussed using the preliminary accuracy assessment due to "the non-probabilistic nature of the sampling and the small sample size" as correctly pointed out in the IMR. As pointed out by the RP, this can be done once the independent accuracy assessment is finalised.<br><br>Hence, the verification team deems that this CAR can be closed and recommends, via a FAR, the RP to inform the relevant stakeholders of the uncertainty of the estimate once the accuracy assessment is completed.<br><br>**CL5 is closed.** |

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| | | | FAR 5 is open. |
| CL 6 | Comment stakeholder<br>The RP is requested to discuss in the IMR how the missing data caused by cloud cover are handled in the estimations of forest/non-forest and the changes. | NOTE: IMR Updated - Refer to Section 7.1<br>The process of reviewing areas of persistent cloud was explained to DNV during the site visit. This is repeated as follows:<br><br>1. The problem of cloud cover is resolved by viewing multiple images for each time period. An alternative image source is usually available for all cloudy areas. Where cloud cover is persistent across time periods and imagery, there are is assume to be unchanged and can be revised in subsequent years if there has been change.<br><br>2. An analysis of the cloud cover in the combined Landsat and DMC imagery reveals only a very small fraction of the total area (<0.0001% ) was obscured by cloud for the entire analysis period (1990-2010).<br><br>3. Mosaics of cloud-free MODIS imagery datasets for Sept 2009 (end of the benchmark period) and Sept 2010 (end of year 1) and radar datasets were also reviewed for the cloudy areas. | The verification team checked the latest version of the IMR. The verification team confirms that it has been updated with additional information on how missing data caused by cloud cover are handled.<br>The verification team deems that the response given and the update in the IMR gives a satisfactory answer to the stakeholder.<br><br>**CL6 is closed.** |

| CL ID | Clarification Request | Response by Responsible Party of the assertions | DNV's assessment of response by Responsible Party of the assertions |
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| | | **Forest and Non-Forest** | |
| | | 4. In the absence of alternative image sources areas obscured by persistent cloud 1995/96 radar imagers were consulted if there was still doubt then the area was assigned to the surrounding land cover type and boundaries were interpolated. (point 1 above) | |
| | | **Forest Change;** | |
| | | 5. A pragmatic approach has been taken. If an area is not observed then it can not be mapped. However, if these areas are identified in subsequent periods they will be mapped and included in that period. This need for cloud-free data is acknowledged and has been included as part of the long-term monitoring strategy. | |
| | | 6. Further the accuracy assessment is the study that will provide the basis on which forest / non-forest and change accuracy is determined. | |
| | | **Forest and Non-Forest** | |
| | | 7. In the absence of alternative image sources areas obscured by persistent cloud 1995/96 radar images were consulted if there was still doubt then | |

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| | | the area was assigned to the surrounding land cover type and boundaries were interpolated. (point 1 above)<br><br>**Forest Change;**<br>8. A pragmatic approach has been taken. If an area is not observed then it cannot be mapped. However, if these areas are identified in subsequent periods they will be mapped and included in that period. This need for cloud-free data is acknowledged and has been included as part of the long-term monitoring strategy. | |
| CL 7 | Comment stakeholder<br>The RP is requested to include in the IMR all the information available on the concept and definition of an IFL as explained in the web site http://www.intactforests.org/concept.html /76/ | **NOTE**<br>The extract from the website hereby referenced by DNV is already included in the IMR on page 86 in its entirety. Is this what is being referred to or something else?<br><br>This clarification request is confusing and requests for the RP to duplicate text already in the IMR. | The verification team has checked the IMR and includes all the information of the concept and definition of an IFL.<br><br>**CL7 is closed.** |

## Forward action requests from this verification

| FAR ID | Forward action request | Response by Responsible Party of the assertions | DNV's assessment of response by Responsible Party of the assertions |
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| 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. <br><br> Non-binding verification <br> Additionally, the verification team | Point noted. <br><br> 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). <br><br> 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. <br><br> The conclusion for the "strong recommendation" being may be somewhat overstated. <br><br> 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. <br><br> Text inserted in Section 10.3.3 | To follow. |

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

| FAR ID | Forward action request | Response by Responsible Party of the assertions | DNV's assessment of response by Responsible Party of the assertions |
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| FAR 2 | The RP is recommended for future 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. | NOTED<br><br>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.<br><br>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.<br><br>Text inserted in Section 5. Mapping Guide for digitising has been developed and attached as one step in the process. | To follow. |
| FAR 3 | <u>Non-binding recommendation</u><br>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.<br>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<br><br>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:<br><br>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. | Not applicable.<br><br>(*For your information*<br><br>*Contact with INPE should be made with Alberto Setzer at email:* *alberto.setzer@cptec.inpe.br*<br><br>*It is correct that this server at INPE does not have ready to serve Guyana data, but that does not mean that that hotspot data cannot be derived from the AVHRR or GOES data in the archive from this location or via the Global Change Master* |

| FAR ID | Forward action request | Response by Responsible Party of the assertions | DNV's assessment of response by Responsible Party of the assertions |
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| | | 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. | *Directory at NASA (see http://gcmd.nasa.gov/index.html).)* |
| | | 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 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. | |

| FAR ID | Forward action request | Response by Responsible Party of the assertions | DNV's assessment of response by Responsible Party of the assertions |
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|        |                        | 6. Additionally, a temporal search was conducted using the website (http://www.dpi.inpe.br/proarco/bdquei madas/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 |
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| FAR 4 | Non-binding recommendation<br>During the site visit the verification team checked that some quality issues encountered during the verification were due to :<br>- 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.<br>- The reporting period; it is important that the reporting period is adjusted in accordance with best availability of cloud free imaginery.<br>- Lack of standardization in the reporting of results and their verification.<br>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<br><br>1. Unlike GHG reporting where a common reporting format is prescribed, best endeavours were made to provide as much information as possible<br><br>2. GFC undertakes, with additional guidance, to improve the reporting structure, content and scope.<br><br>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)<br><br>No insertion in report as this is an administrative point for Guyana and Norway to follow up on. | Not applicable. |
| 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 | NOTED<br><br>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. | To follow. |

| FAR ID | Forward action request | Response by Responsible Party of the assertions | DNV's assessment of response by Responsible Party of the assertions |
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| | from stakeholders and to confirm that the estimation is within an acceptable range.<br><br>-Furthermore, the verification team recommends for future verification events to provide a complete accuracy assessment 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.<br><br>-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 |
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| 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.<br><br>-Furthermore, as part of the next verification event, it shall be checked that the use of a correct and more appropriate logging collateral damage factor is applied for the relevant indicator. | Not applicable. | To follow. |
| FAR 7 | <u>Non-binding recommendation</u><br>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:<br>- Expanding the stakeholder consultation period; | Not applicable. | Not applicable. |

| FAR ID | Forward action request | Response by Responsible Party of the assertions | DNV's assessment of response by Responsible Party of the assertions |
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| | - Direct invitation of relevant stakeholders to provide their comments;<br>- Improvement of the media used to invite comments; | | |
| FAR 8 | As part of the verification of Indicator 2a some island polygons which would fail either the 10km size or 2 km width test were detected. This was corrected by the RP as part of this verification.<br>RP is recommended to include the cleaning of these islands in their tool to estimate the IFL.<br>This shall be checked in the next verification event. | Island polygons will be mapped in year 2 assessment. The mechanism for doing this will be determined as part of the Year 2 assessment to achieve the desired results.<br><br>Whether this will be accomplished by altering the Program/tool created to map IFL, or by some other way, has not been decided.<br><br>The most effective mechanism to execute this recommendation will be instituted in the Year 2 assessment. | To follow. |
| 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.<br>As a result, during the manual interpretation of deforestation carried out | 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.<br><br>Additionally, the JCN is quite clear that shifting agriculture is to be treated as a degradation event and the indicator that | To follow. |

| FAR ID | Forward action request | Response by Responsible Party of the assertions | DNV's assessment of response by Responsible Party of the assertions |
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| | 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.<br>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 has recovered.<br>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.<br><br>-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.<br><br>2.On the other hand, in Year 1, only 57 ha have been identified as "shifting | speaks to "slash and burn agriculture" states the following:<br><br>Not considered relevant in the interim period before a proper MRV-system is in place.<br><br>The IMR adheres strictly to the JCN.<br><br>DNV's recommendation on shifting agriculture in FAR 9, is duly noted and approaches to this, will be informed by JCN requirements. | |

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| | 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 resolutions involved. | 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. | To follow. |

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# APPENDIX B

## CURRICULA VITAE OF THE VERIFICATION TEAM MEMBERS

**Andres Espejo Miñan**

*Holds a Bachelor/Master Degree in Forestry Engineering. Having an overall experience of around five years. Prior to joining DNV having 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 of around one year 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) and Forestry (Sectoral Scope 14).*

**Peter Schlesinger**

*Holds a Masters degree in International Development. He has more than 20 years experience with nonprofit international development organizations and commercial consulting firms with particular emphasis in forest carbon and land use assessment for Reducing Emissions from Deforestation and Forest Degradation (REDD), modeling, and monitoring using GIS and remote sensing technologies. With the Woods Hole Research Center (1989-2006), he trained many international scholars in forest and land cover mapping techniques and co-authored many refereed science articles and datasets. Peter pioneered land and forest cover mapping and modeling in the Amazon Basin and Russian Federation. He developed GIS programming skills at Clark University and has been a beta-tester of all versions of IDRISI geographic analysis software.*

*His career of providing technical excellence on five continents in areas of agriculture, forestry, and climate change science demonstrates his competence in the remote sensing and GIS sectors. He is currently working for Carbon Decisions International, advising national and regional governments, not for profits, and commercial organizations in the development of CDM A/R and REDD deforestation baseline modeling for tropical jungle habitats in Peru, Mexico, Guatemala, Tanzania, and Senegal.*

**Misheck Chomba Kapambwe**

*Dr Kapambwe holds a PhD in Carbon Accounting (forest products) and has done a Masters Degree in Wood Science, Graduate Diploma in Forest Industries, Diploma in Forestry and Diploma in Sawmilling Technology and has done a short term courses in Carbon Accounting and Management. Having an overall experience of around Twenty years. Prior to joining DNV having around twenty years experience in research in the areas of greenhouse accounting (including ecological footprinting) and climate change policy. His experience also covers the fields of AFOLU project and methodology validation, forest products processing, environmental management and resource conservation in developing countries and Australia.*

*His qualification, industrial experience and experience in forestry and forest industry demonstrate his sufficient sectoral competence in forestry.*