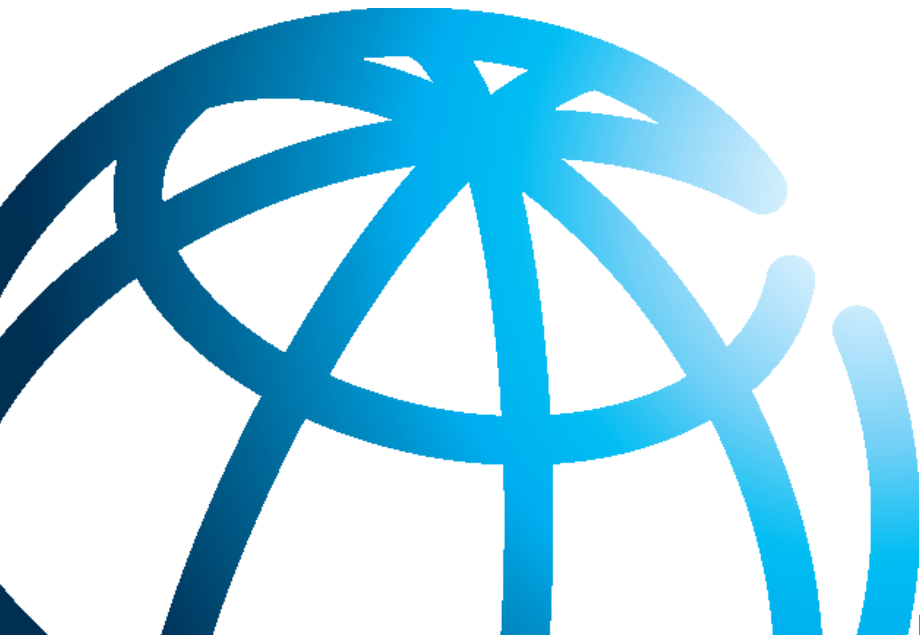




WORLD BANK GROUP
Climate Change

Updates on FCPF Requirements: Uncertainty analysis, technical corrections, monitoring report

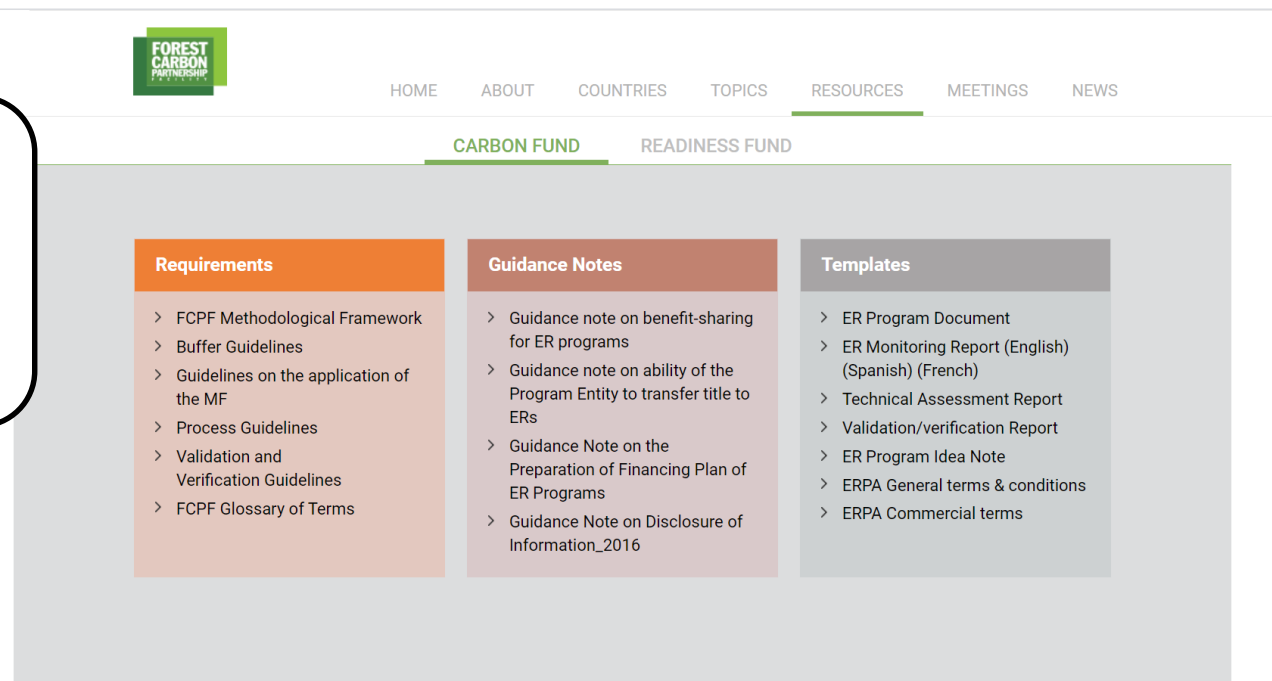
Andres Espejo
Catalina Becerra
December , 2020



CONTENTS

- Guidelines on Uncertainty Analysis of Emission Reductions (Nº 4)
- Guidelines on Technical corrections (Nº 2)
- Monitoring Report template

All documents discussed today may be found in the FCPF website > Resources > Requirements and Templates



Guidelines on Uncertainty Analysis of Emission Reductions (Nº 4)

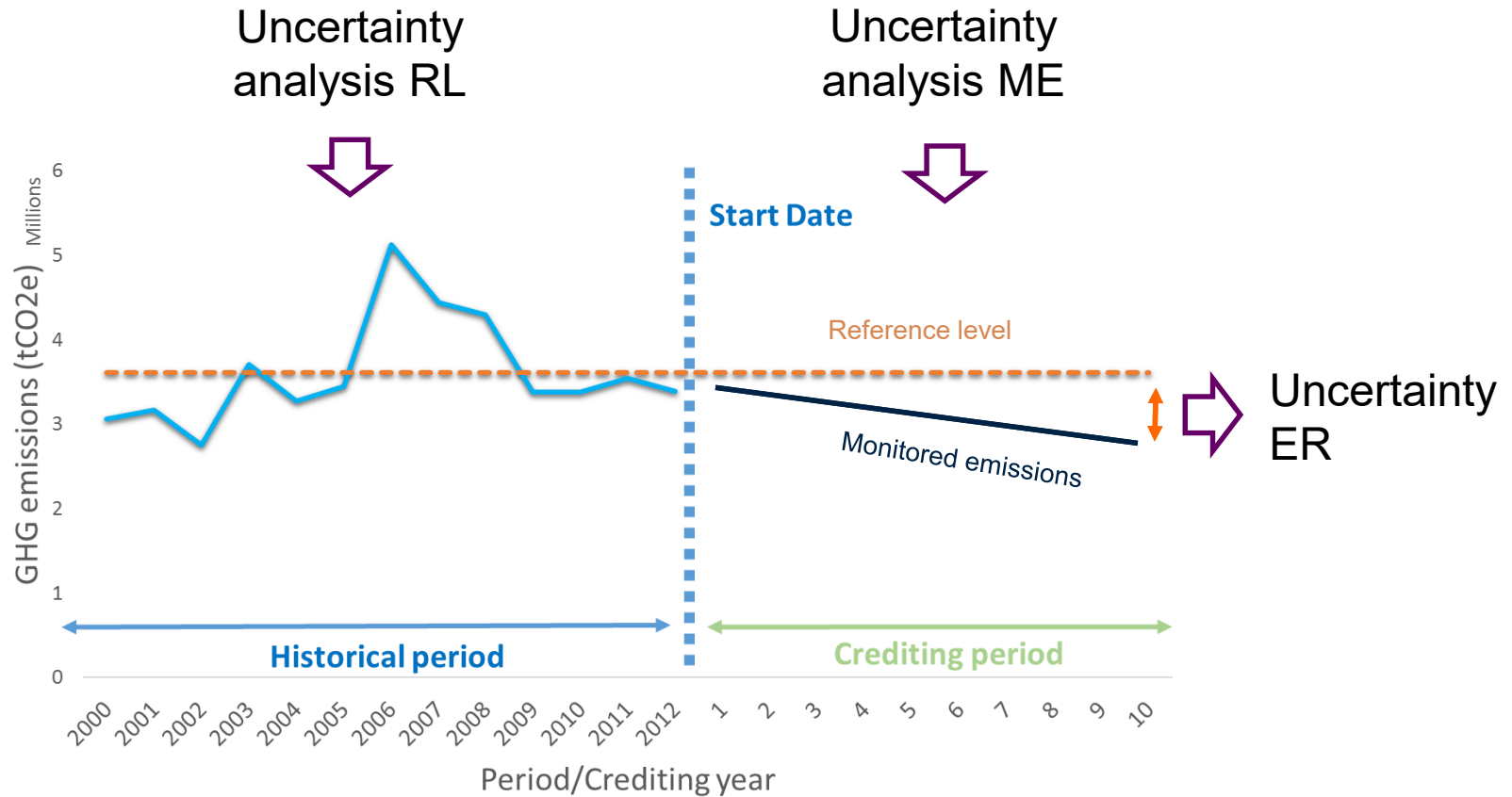
GUIDELINES ON UNCERTAINTY ANALYSIS OF ERs

- Guidelines on the application of the Methodological Framework N° 4 on “Uncertainty Analysis of Emission Reductions” were approved by Carbon Fund Participants on November 11, 2020
- Guidelines are mandatory → uncertainty analysis shall be conducted following the Guidelines
- Guidelines provide clarity on how criteria 7, 8 and 9 of the methodological framework shall be applied

CRITERION 7, 8, 9- UNCERTAINTY

- 3-step approach to manage Uncertainty:
 1. **Identify and assess sources** of **Uncertainty of RL and monitored emissions (ME)** (Criterion 7)
 2. **Reduce uncertainty** of **RL and ME** where feasible and cost effective by minimizing systematic errors (bias) and random errors (precision) (Criterion 8)
 3. **Residual uncertainty** of AD and EF in **RL and ME is quantified**, uncertainty of ERs is quantified, and ERs are set aside in buffer (Criterion 9)
- **Indicator 9.2 and 9.3:** The final objective of the Uncertainty Analysis is to provide an estimate of uncertainty of Emission Reductions in the form of the relative half-width confidence interval at the 90% confidence level

CRITERION 7, 8, 9- UNCERTAINTY



CRITERION 7, 8, 9- UNCERTAINTY

However...

Uncertainty RL + Uncertainty ME \neq Uncertainty ER

There are sources of uncertainty that are significant for RL and EM, but are not significant for ER estimation, e.g. same Emission Factors are used for RL setting and ME

CRITERION 7, 8, 9- UNCERTAINTY

- 3-step approach to manage Uncertainty:
 1. **Identify and assess sources** of **Uncertainty of RL and monitored emissions** (Criterion 7)
 2. **Reduce uncertainty** of **RL and monitored emissions** where feasible and cost effective by minimizing systematic errors (bias) and random errors (precision) (Criterion 8)
 3. **Residual uncertainty** of AD and EF in **RL and monitored emissions is quantified**, uncertainty of ERs is quantified, and ERs are set aside in buffer (Criterion 9)
- **Indicator 9.2 and 9.3:** The final objective of the Uncertainty Analysis is to provide an estimate of uncertainty of Emission Reductions in the form of the relative half-width confidence interval at the 90% confidence level

CRITERION 7, 8, 9- UNCERTAINTY

- 3-step approach to manage Uncertainty:
 1. **Identify and assess sources** of ~~Uncertainty of RL and monitored emissions~~ **Emission Reductions (ER)** (Criterion 7)
 2. **Reduce uncertainty** of ~~RL and monitored emissions~~ **ER** where feasible and cost effective by minimizing systematic errors (bias) and random errors (precision) (Criterion 8)
 3. **Residual uncertainty** of ~~AD and EF in~~ ~~RL and monitored emissions~~ **is quantified**, ~~uncertainty of ERs is quantified~~, and ERs are set aside in buffer (Criterion 9)

Change in approach: Uncertainty analysis is simplified. The 3-step approach focuses on uncertainty of ERs

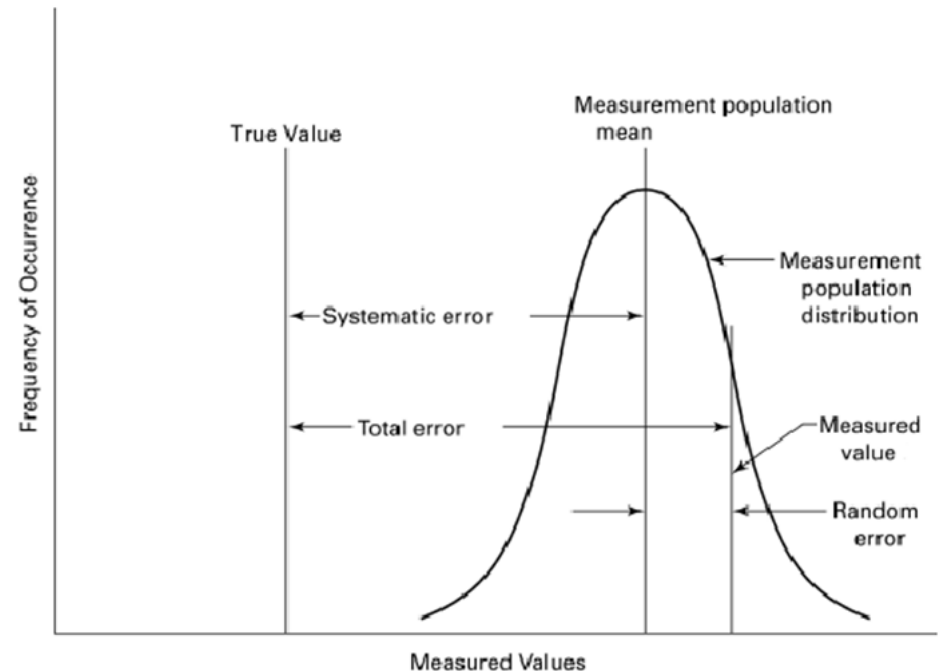
OVERVIEW OF THE GUIDELINES

- Assume that the integration framework is Activity Data x Emission Factors. Might be refined considering other circumstances
- Provide a list of sources of uncertainty to be addressed by countries (Criterion 7) → Fixed list
- Include an assessment on the impact of the listed sources on bias or precision (c.f. next slide).
- Note how the source of uncertainty shall be addressed:
 - Systematic errors: Discussion, application of SOP/QA/QC,...
 - Random errors: Discussion, propagation of uncertainty,...
- Define the errors to propagate through MC
- Provide basic guidance on conducting MC simulations

SYSTEMATIC AND RANDOM ERRORS

Uncertainty consists of two components:

1. Bias or systematic error (lack of accuracy) occurs, e.g., due to flaws in the measurements or sampling methods or due to use of an EF that is not suitable. These errors shall be reduced as far as practical. If errors cannot be reduced further, the conservativeness principle shall apply.
2. Random error (lack of precision) is a random variation above or below a mean value. It cannot be fully avoided but can be reduced by, for example, increasing the sample size.



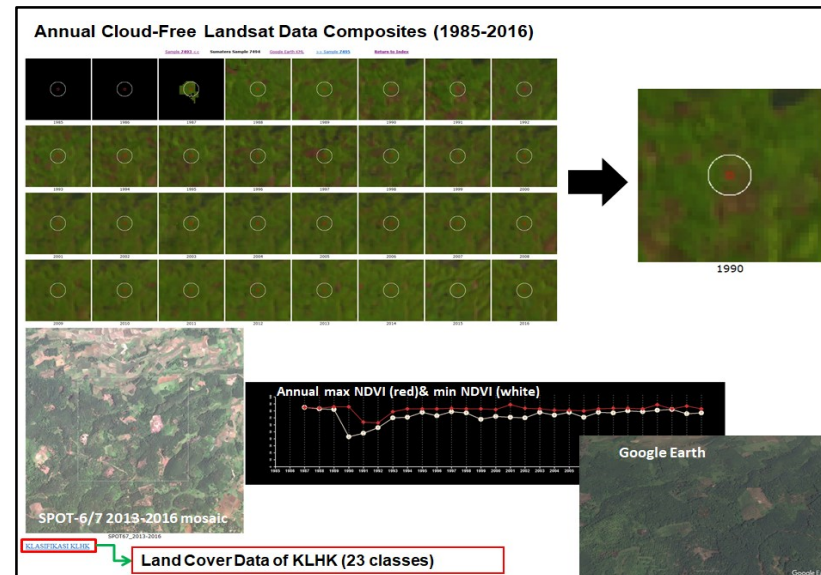
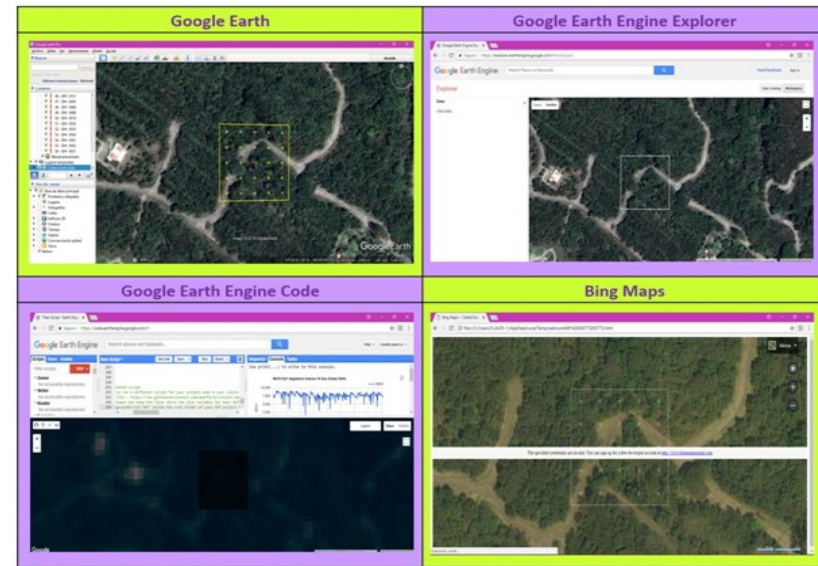
SOURCES OF ERROR

	Source	Systematic error	Random error	Propagate uncertainty
Activity Data	1. Measurement	✓	✓	NO
	2. Representativeness	✓	✗	NO
	3. Sampling	✗	✓	YES
	4. Extrapolation	✓	✗	NO
	5. Approach 3	✓	✗	NO
Emission Factor / Removal Factor	1. DBH/H Measurement	✓	✓	NO
	2. Plot delineation	✓	✓	NO
	3. Wood density	✓	✓	NO
	4. Biomass allometric model	✓	✓	YES/NO
	5. Sampling	✗	✓	YES
	6. Other parameters	✓	✓	YES
	7. Representativeness	✓	✗	NO
Integration	1. Model	✓	✗	NO
	2. Integration	✓	✗	NO

ACTIVITY DATA – 1. MEASUREMENT

- Relates to visual interpretation of sample units
- Contribution = High (bias/random)
- Addressed through QA/QC procedures:
 - SOPs
 - Use of adequate sources of imagery
 - Training procedures
 - Re-interpretation of SUs.
- Quantify and propagate residual uncertainty = NO

Systematic error	Random error
☑	☑

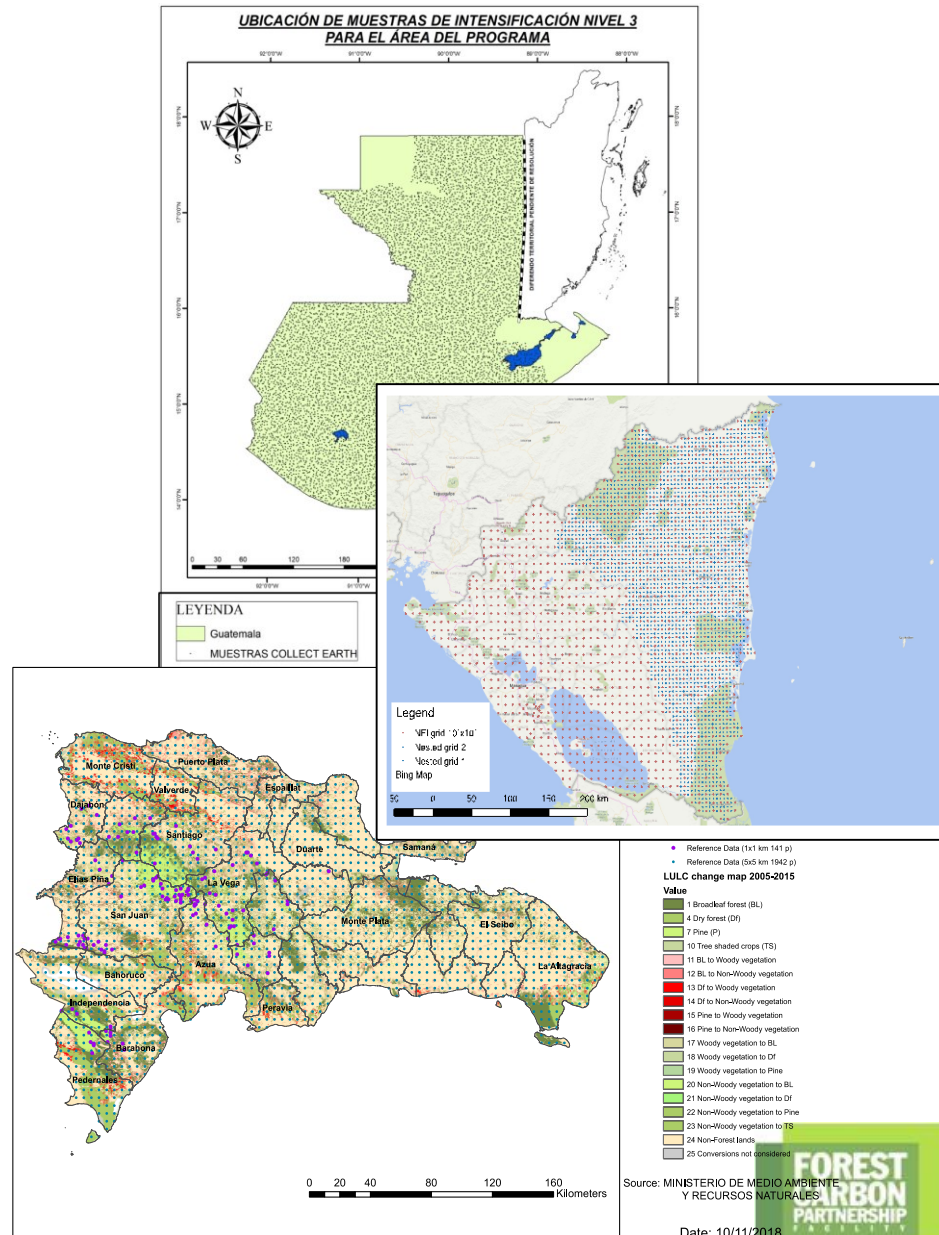


ACTIVITY DATA – 2.

REPRESENTATIVENESS

- Relates to the representativeness of the sample
- Contribution = High/Low (bias)
- Addressed through:
 - QA/QC
- Quantify and propagate residual uncertainty = NO

Systematic error	Random error
<input checked="" type="checkbox"/>	<input type="checkbox"/>



ACTIVITY DATA – 3. SAMPLING

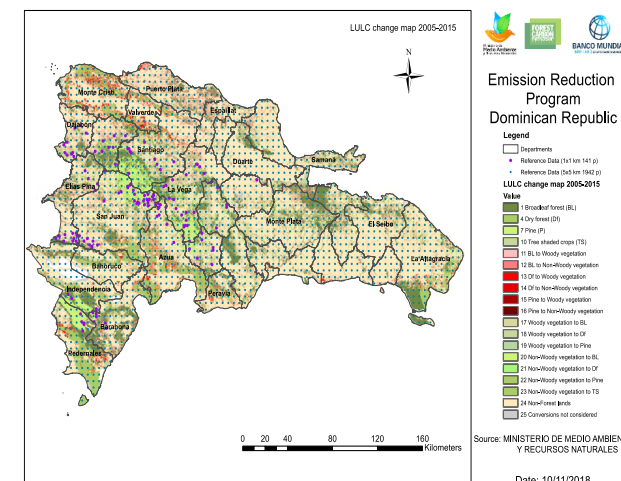
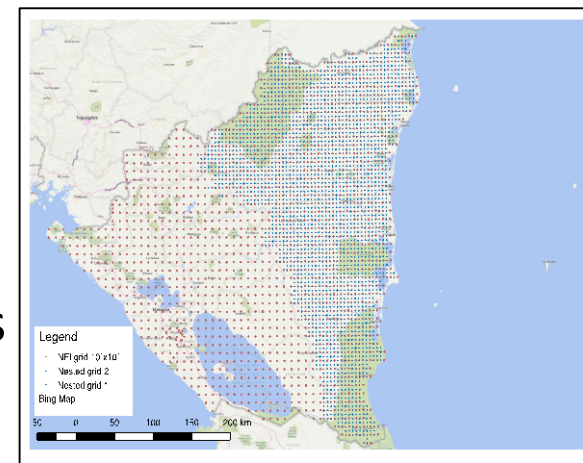
Systematic error



Random error



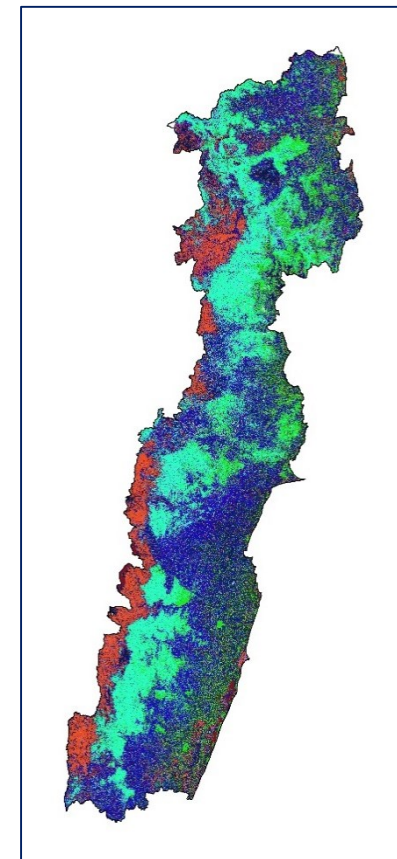
- Is the statistical sampling error
- Contribution = High (random)
- Addressed through:
 - QA/QC
 - Use reference data and unbiased estimators for estimating activity data and uncertainty
 - Other guidance: [GFOI FAQ on area estimation](#), [Section 5.1.5 of the MGD \(GFOI 2016\)](#), [Good practices for estimating area and assessing accuracy of land change by Olofsson et al. \(2014\)](#).
- Quantify and propagate residual uncertainty = YES



ACTIVITY DATA – 4. EXTRAPOLATION

Systematic error	Random error
<input checked="" type="checkbox"/>	<input type="checkbox"/>

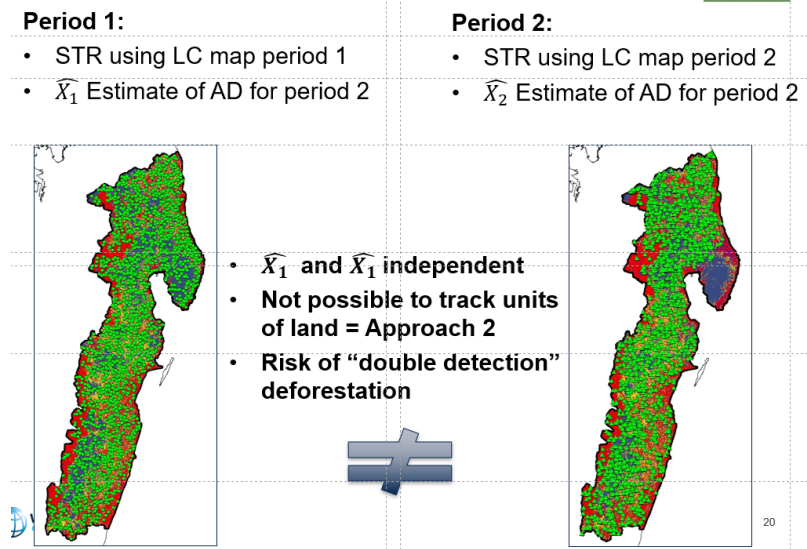
- Extrapolation of an estimate of the population to subpopulations which may lead to bias.
- ER Programs should avoid using these methods and if they are not able to avoid them, they should justify if this will lead to an overestimation of Emission Reductions and apply any corrective measures.
- Contribution = High/Low (bias)
- Addressed through:
 - QA/QC
- Quantify and propagate residual uncertainty
= NO



ACTIVITY DATA – 5. APPROACH 3 (TRACKING OF LANDS)

- Two independent surveys to estimate activity data in period 1 and period 2 without conducting tracking of lands = **risk of double detection!**
- Contribution = High/Low (bias)
- Addressed through:
 - Avoid Independent Surveys through permanent sampling units
 - Define transition rules
 - QA/QC
- Quantify and propagate residual uncertainty = NO

Systematic error	Random error
<input checked="" type="checkbox"/>	<input type="checkbox"/>



EMISSION FACTORS – 1, 2

MEASUREMENT DBH/H, PLOT

Systematic error	Random error
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>



- While measurement errors are significant at the tree level, they usually average out at plot level.
- This source of error should be negligible for ER estimation provided minimal QA/QC procedures are in place.
- Contribution = High (bias)/Low (random)
- Addressed through:
 - QA/QC
- Quantify and propagate residual uncertainty = NO



EMISSION FACTORS – 3 WOOD

DENSITY ESTIMATION

Systematic error	Random error
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>



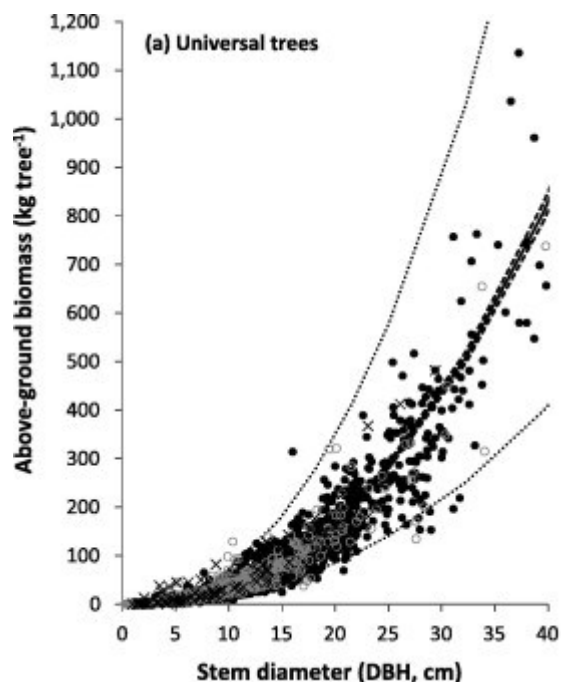
- Required when using allometric equations.
- Usually not measured but extracted from scientific sources (e.g., IPCC).
- Contribution = High (bias)/Low (random)
- Addressed through:
 - QA/QC
 - Protocols for the identification of Tree species
 - Decision trees
- Quantify and propagate residual uncertainty = NO

EMISSION FACTORS – 4.

ALLOMETRIC MODELS

Systematic error

Random error

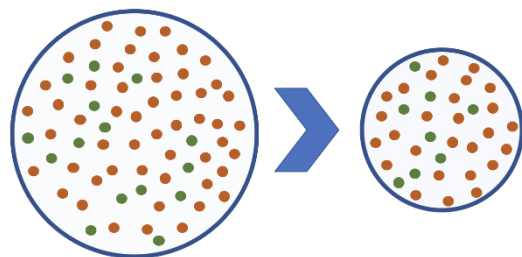


- Two sources of uncertainty:
 - Choice of the allometric equation.
 - Uncertainty of coefficients and residue
- REDD Countries shall discuss the source of error and demonstrate that its contribution to overall uncertainty is low.
- Contribution = High (bias) & High/Low (random)
- Addressed through:
 - MC Simulation or increase the sampling uncertainty to 10% at 90% (random)
 - Application of correction factors (bias)
 - QA/QC (bias)
- Quantify and propagate residual uncertainty = YES/NO

EMISSION FACTORS – 5. SAMPLING

Systematic error

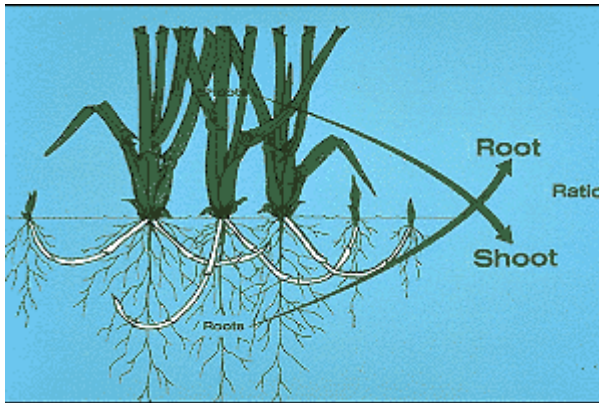
Random error



- Applicable for cases when the carbon densities of forest used to derive emission factors are based on a terrestrial inventory based on a probabilistic design
- Sampling uncertainty is the statistical variance of the estimate of aboveground biomass, dead wood or litter. This source of uncertainty is random
- Contribution = High (random)
- Addressed through:
 - Increased sampling / better stratification
 - QA/QC
- Quantify and propagate residual uncertainty = YES

EMISSION FACTORS – 6. OTHER PARAMETERS

Systematic error	Random error
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

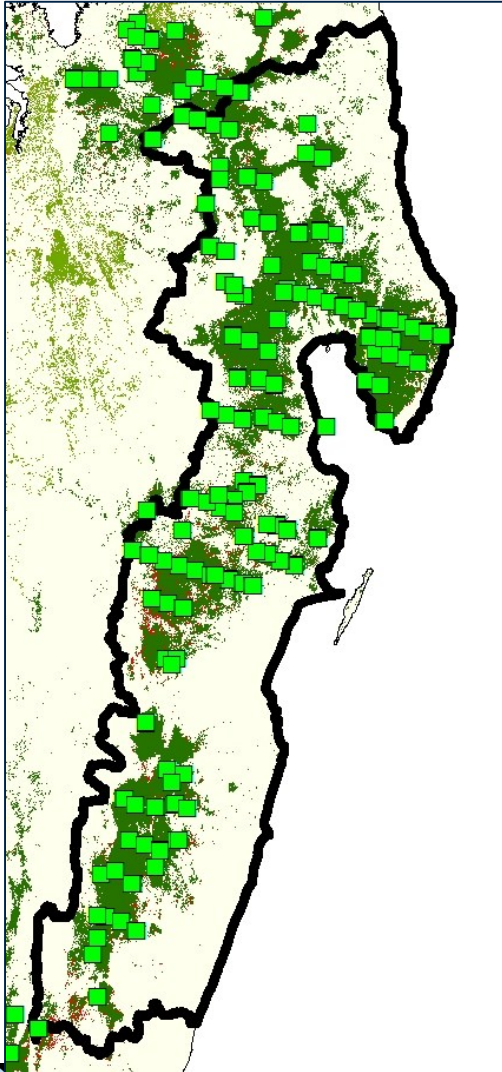


- Other parameters: Root-to-shoot ratio, carbon fraction, BEF (if applicable), etc.
- Not measured but extracted from bibliography, e.g. IPCC
- The random error of each individual parameter might be low, but the aggregated effect might be high
- Contribution = High (bias / random)
- Addressed through:
 - QA/QC
- Quantify and propagate residual uncertainty = YES

EMISSION FACTORS – 7.

REPRESENTATIVENESS

Systematic error	Random error
<input checked="" type="checkbox"/>	<input type="checkbox"/>

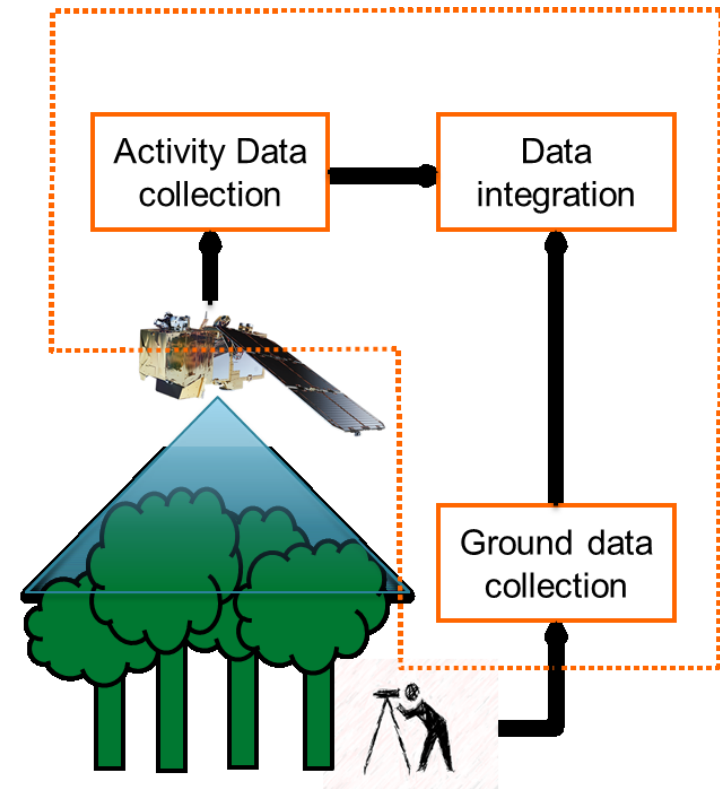


- Representativeness of the estimate which is related to the sampling design
- If the sample is not representative for the area of interest, the estimate given by the sample will not be representative and can cause bias
- Contribution = High/Low (bias)
- Addressed through:
 - QA/QC
 - Correct Sampling Design
- Quantify and propagate residual uncertainty = NO

INTEGRATION – 1. MODEL

Systematic error	Random error
<input checked="" type="checkbox"/>	<input type="checkbox"/>

- Usually, sources of both random and systematic error are the calculations themselves (e.g., mistakes made in spreadsheets) and the process of data preparation (e.g., pre-processing, data cleansing, data transfer, etc.).
- All models are simplification of reality, and this simplification could be a source of bias to emission reductions.
- Contribution = High/Low (bias)
- Addressed through:
 - QA/QC
- Quantify and propagate residual uncertainty = NO



INTEGRATION – 2. INTEGRATION

Systematic error	Random error
<input checked="" type="checkbox"/>	<input type="checkbox"/>

- lack of comparability between the transition classes of the Activity Data and those of the Emission Factors.
- AD is usually estimated through remote-sensing observations, whereas Emission Factors for a specific forest type could be based on ground-based observations of the forest type. These may not be comparable, and it may represent a source of bias
- Contribution = High/Low (bias)
- Addressed through:
 - QA/QC
- Quantify and propagate residual uncertainty
= NO



SOURCES OF ERROR

	Source	Systematic error	Random error	Propagate uncertainty
Activity Data	1. Measurement	✓	✓	NO
	2. Representativeness	✓	✗	NO
	3. Sampling	✗	✓	YES
	4. Extrapolation	✓	✗	NO
	5. Approach 3	✓	✗	NO
Emission Factor / Removal Factor	1. DBH/H Measurement	✓	✓	NO
	2. Plot delineation	✓	✓	NO
	3. Wood density	✓	✓	NO
	4. Biomass allometric model	✓	✓	YES/NO
	5. Sampling	✗	✓	YES
	6. Other parameters	✓	✓	YES
	7. Representativeness	✓	✗	NO
Integration	1. Model	✓	✗	NO
	2. Integration	✓	✗	NO

SOURCES OF ERROR

	Source	Systematic error	Random error	Propagate uncertainty
Activity Data	1. Measurement	✓	✓	NO
	2. Representativeness	✓	✗	NO
	3. Sampling	✗	✓	YES
	4. Extrapolation	✓	✗	NO
	5. Approach 3	✓	✗	NO
Emission Factor / Removal Factor				NO
				NO
				NO
				YES/NO
				YES
Integration				YES
	7. Representativeness	✓	✗	NO
Integration	1. Model	✓	✗	NO
	2. Integration	✓	✗	NO

- Countries need to demonstrate that have implemented adequate QA/QC procedures to address all sources
- This shall be sufficiently described in the Monitoring Report

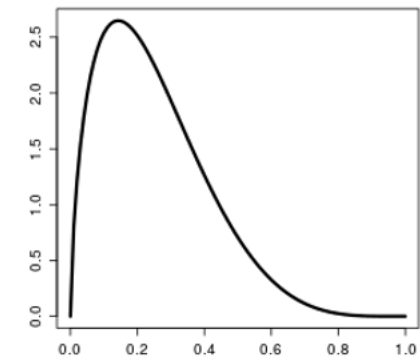
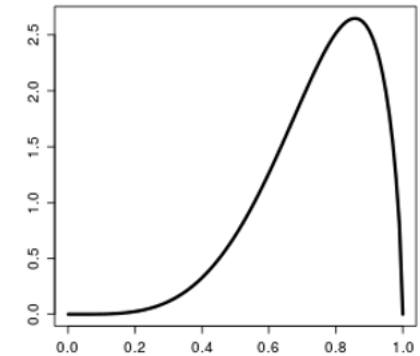
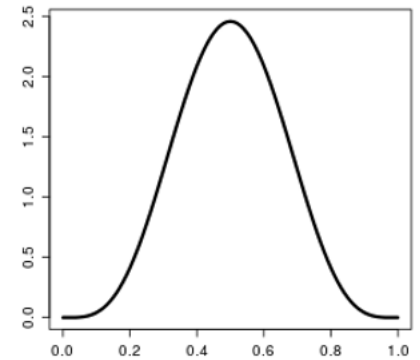
SOURCES OF ERROR

	Source	Systematic error	Random error	Propagate uncertainty
Activity Data	1. Measurement	✓	✓	NO
	2. Representativeness	✓	✗	NO
	3. Sampling	✗	✓	YES
	4. Extrapolation	✓	✗	NO
	5. Emission factor	✓	✓	NO
Emission Factor / Removal Factor	6. Uncertainty in input data	✓	✓	NO
	7. Uncertainty in model	✓	✓	NO
	8. Uncertainty in input data	✓	✓	NO
	3. Wood density	✓	✓	NO
	4. Biomass allometric model	✓	✓	YES/NO
	5. Sampling	✗	✓	YES
	6. Other parameters	✓	✓	YES
Integration	7. Representativeness	✓	✗	NO
	1. Model	✓	✗	NO
	2. Integration	✓	✗	NO

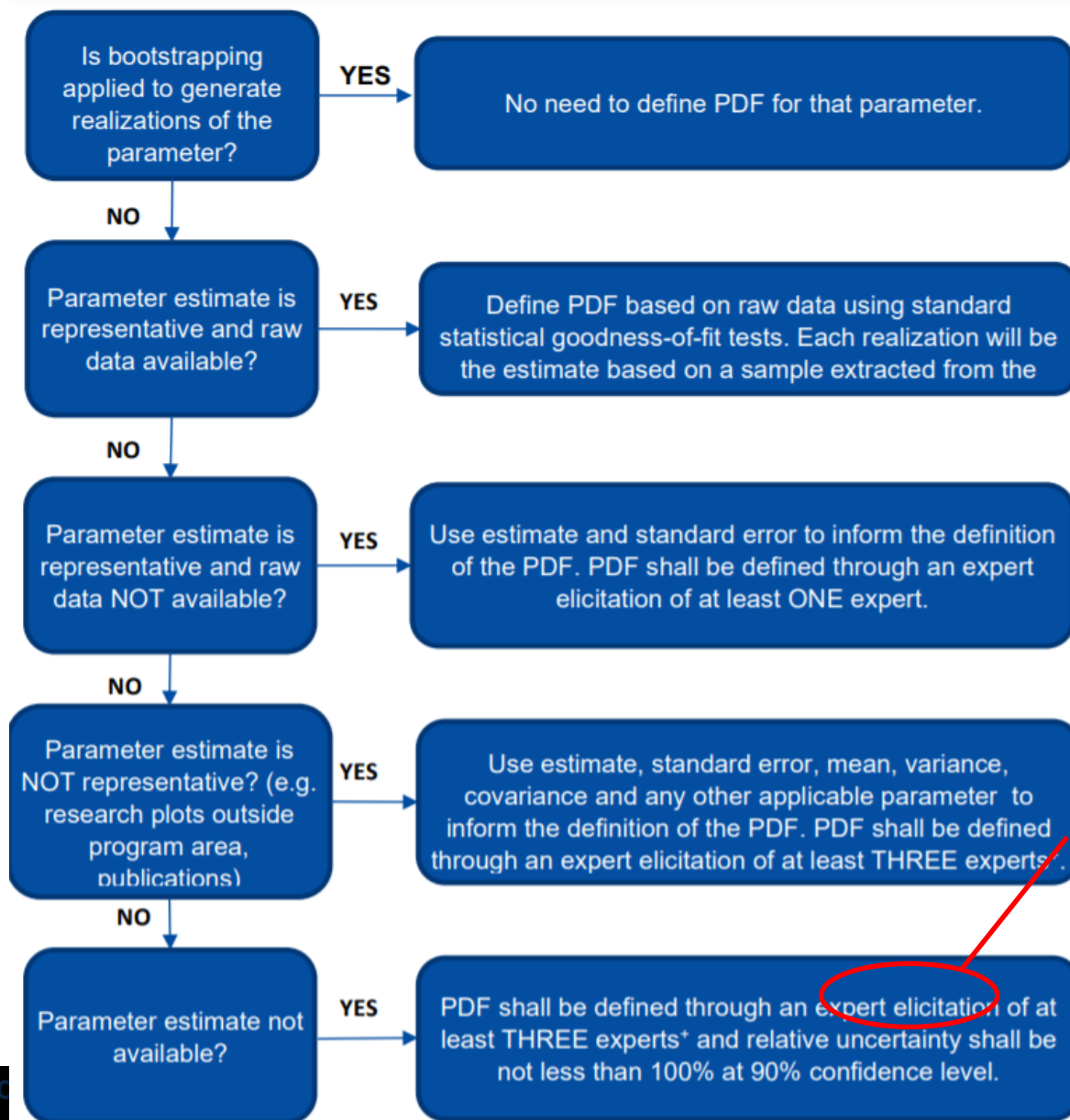
MC simulations are simplified as only few sources need to be considered

MONTE CARLO AND PDFs

- ER Programs shall apply Monte Carlo methods (IPCC Approach 2) for quantifying the Uncertainty of Emission Reductions.
- ER programs may use bootstrapping as an alternative to Monte Carlo → does not require defining Probability Density Functions (PDFs)
- The PDF shall be well justified and shall adhere to the guidance provided in Section 3.2.2.4 of Chapter 3, Volume 1 of the 2006 IPCC Guidelines (and its 2019 refinement).
- Guidance to select the PDF is provided:



MONTE CARLO AND PDFs



Relevant experience in the applicable ecosystems and in REDD+

SENSITIVITY ANALYSIS

- ER Programs shall carry out a sensitivity analysis to identify the relative contribution of each parameter to the overall uncertainty of ERs
- Sensitivity analysis is conducting by ‘switching off’ each source of uncertainty (presented before) individually, and assessing the impact to overall uncertainty of Emission Reductions.
- ER Programs should consider reducing the uncertainty by improving methods, collecting additional or new data, etc. in the next monitoring event.
- ER Programs shall maintain a reproduceable record of the sensitivity analysis so that it provides enough information for improvements in future monitoring events

REPORTING

- The uncertainty analysis shall be transparently reported
- The Monitoring Report Template provides sections and text to guide countries in preparing their Monitoring Reports

Guidelines on Technical corrections (N° 2)

GUIDELINES ON TECHNICAL CORRECTIONS – VERSION 2.0

- The first version of the Guidelines on Technical Corrections was approved in November 2018
- These guidelines enable countries to improve the uncertainty (bias or precision) of their Reference Levels before the first Verification
- Version 2.0 of the Guidelines on Technical Corrections were approved in November 2020
- Improvements considered lessons learned from the almost 2 years of implementation of version 1.0

GUIDELINES ON TECHNICAL CORRECTIONS – VERSION 2.0

- This new version:
 - Additional types of revisions in the positive list (i.e. changes that are accepted and do not require prior approval from the FCPF)
 - Describes the process in the case the technical correction is not in the positive list, i.e. prior approval from FCPF
 - Simplifies the process of notification to the FCPF

POSITIVE LIST OF ALLOWABLE TECHNICAL CORRECTIONS

Only the following types of technical corrections are allowed:

1. Emission factors – a. Replacement of emission or removal factors by others with improved accuracy

1. Emission Factors – b. Replacement of emission or removal factors by others with higher precision and at least equal accuracy

2. Activity Data - a. Improvements to the statistical design for estimation of activity data, i.e. improved sampling intensity, stratification or estimator

2. Activity Data – b. Corrections to activity data resulting from the use of reference data of higher accuracy and/or precision, i.e. higher resolution imagery, better QA/QC, better labelling protocol (correct Approach 3 error)

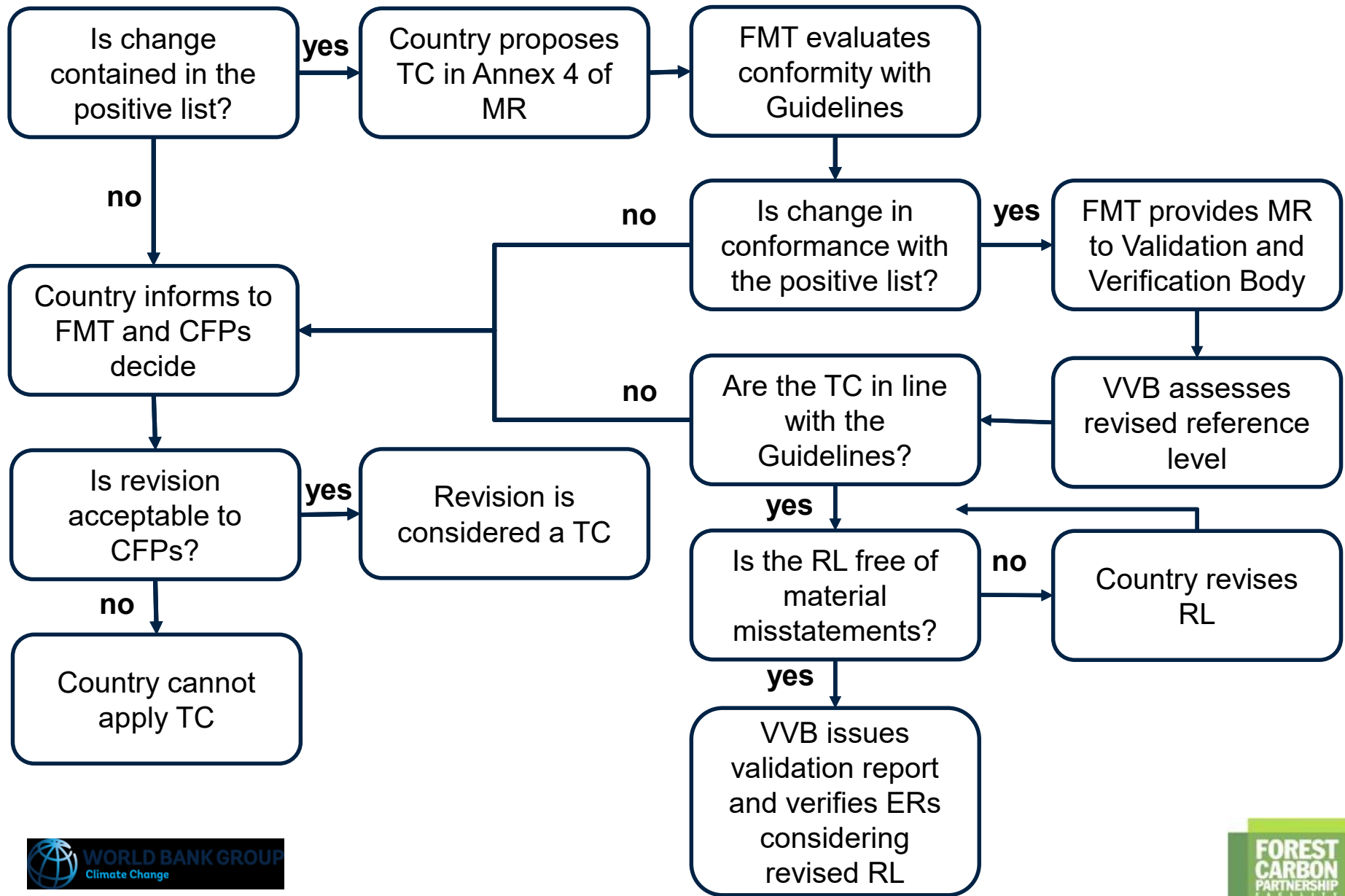
3. Corrections of material errors, omissions and misstatements identified in assumptions, data or calculations used to estimate historical GHG emissions and removals, e.g. mistakes in calculations or transcription errors

4. Corrections required or authorized by Carbon Fund Participants, i.e. required in chair summary, ERPA covenant, or recorded through other means

PROCESS (1/2)

- Notification at ERPA signature no longer required
- Detailed description of technical corrections prior to 3 months before the first reporting period no longer required
- Instead, the REDD Country Participant provides to FMT a complete description of the revised Reference Level as part of Annex 4 of the Monitoring Report
- If the REDD Country participant wishes to propose a revision that is not included in the positive list, it shall notify this to the FMT as soon as possible so as to seek acceptance from CFPs

PROCESS (2/2)



Monitoring Report template

GENERAL STRUCTURE

1. Implementation and operation of the ER Program During the Reporting Period.
2. System for Measurement, Monitoring and Reporting Emissions and Removals occurring within the Monitoring Period
3. Data and Parameters
4. Quantification of Emission Reductions
5. Uncertainty of the estimate of Emission Reductions
6. Transfer of title to ERs
7. Reversals
8. Emission Reductions Available for Transfer to the Carbon Fund

Annex 1: Implementation of safeguards plans

Annex 2: Implementation of the benefit sharing plans

Annex 3: Generation and/or enhancement of priority non-carbon benefits

Annex 4: Reference Level and monitoring plan

MONITORING REPORT COMPLETION

- Main report and Annex 4 shall be complete in order to be able to proceed with Validation/Verification
- Annexes 1, 2 and 3 may be completed at this stage and will be subject to completeness check.
- Incompleteness will not refrain moving forward with Validation and Verification, but will refrain proceeding with payments
- MR with Annex 4 will be made publicly available after the successful completeness check by FMT
- Validation and Verification do not address Annex 1, 2 and 3, which will be assessed by the World Bank through a separate process

GENERAL GUIDANCE TO COMPLETE MR

- Guidance text of the Monitoring Report shall be followed when preparing the Monitoring Report
 - General guidance at the beginning of the MR
 - Specific guidance in each section, within green box
- Structure of the Monitoring Report and format cannot be modified
- FMT will check this during completeness check prior to the launch of the validation/verification
- Validation and Verification Body will also assess compliance with the MR template

1. IMPLEMENTATION AND OPERATION OF THE ER PROGRAM DURING THE REPORTING PERIOD

1.1 Implementation status of the ER Program and changes compared to the ER-PD

- Short description of implementation
- Not assessed by VVB

1.2 Update on major drivers and lessons learned

- Related to leakage
- Assessed by VVB for accuracy and completeness

2 SYSTEM FOR MEASUREMENT, MONITORING AND REPORTING EMISSIONS AND REMOVALS OCCURRING WITHIN THE MONITORING PERIOD

2.1 Forest Monitoring system

- Description of overall system, e.g. roles, processes, organization, QA/QC,...
- Important for VVB to understand overall system and existing controls

2.2 Measurement, monitoring and reporting approach

- Step-by-step explanation of calculation process
- Line diagram required
- Equations shall be presented following the proposed format of the template
- Values of default values such as carbon fractions are reported here

3 DATA AND PARAMETERS

3.1 Fixed data and parameters

- Provide parameters that have been estimated once and will be fixed during Crediting Period (e.g. related to RL, EFs)
- Parameters shall be linked to equations in section 2.2
- Default values such as carbon fractions, root-to-shoot ratios...not reported here
- Report information within tables

3.2 Monitored data and parameters

- Provide parameters that will be estimated in each Reporting Period
- Parameters shall be linked to equations in section 2.2
- Provide spreadsheets and data

4 QUANTIFICATION OF EMISSION REDUCTIONS

4.1 Reference Level

- Provide RL
- Details presented in Annex 4

4.2 Estimation of emissions and removals

- Provide description of calculations following equations presented in 2.2
- Attach spreadsheets

Calculation of ER

- Provide calculations for Monitoring period and Reporting Period
- **Refer to Guideline Number 3**

5 UNCERTAINTY OF THE ESTIMATE OF EMISSION REDUCTIONS

5.1 Identification, assessment and addressing sources of uncertainty

- As per Guidelines 4

5.2 Uncertainty of the estimate of Emission Reductions

- As per Guidelines 4

5.3 Sensitivity analysis and identification of areas of improvement of MRV system

- As per Guidelines 4

6 TRANSFER OF TITLE TO ERS

6.1 Ability to transfer title

- Describe arrangement in place and any challenge
- Not covered by the Verification
- Assessed by WB

6.2 Implementation and operation of Program and Projects Data Management System

- Provide evidence of implementation

6.3 Implementation and operation of ER transaction registry

- Refer to the WB ER Transaction Registry (CATS)
- If a national ER transaction registry, describe link to CATS

6 TRANSFER OF TITLE TO ERS

6.4 ERs transferred to other entities or other schemes

- Describe any ERs sold to other entities by REDD+ projects or the ER Program
- If REDD Country is planning to sell ERs under a different GHG Program/Standard and wishes that ERs from the ER Program not sold to the CF are not issued as FCPF Units it shall describe it here
- If no information is provided or information is not complete, the FMT will assume that all ERs will be issued as FCPF Units
- FCPF Buffer discount will then be applied to all ERs

7 REVERSALS

7.1 Occurrence of major events or changes in ER Program circumstances that might have led to the Reversals during the Reporting Period compared to the previous Reporting Period(s)

- Only required if reversals are reported during reporting period

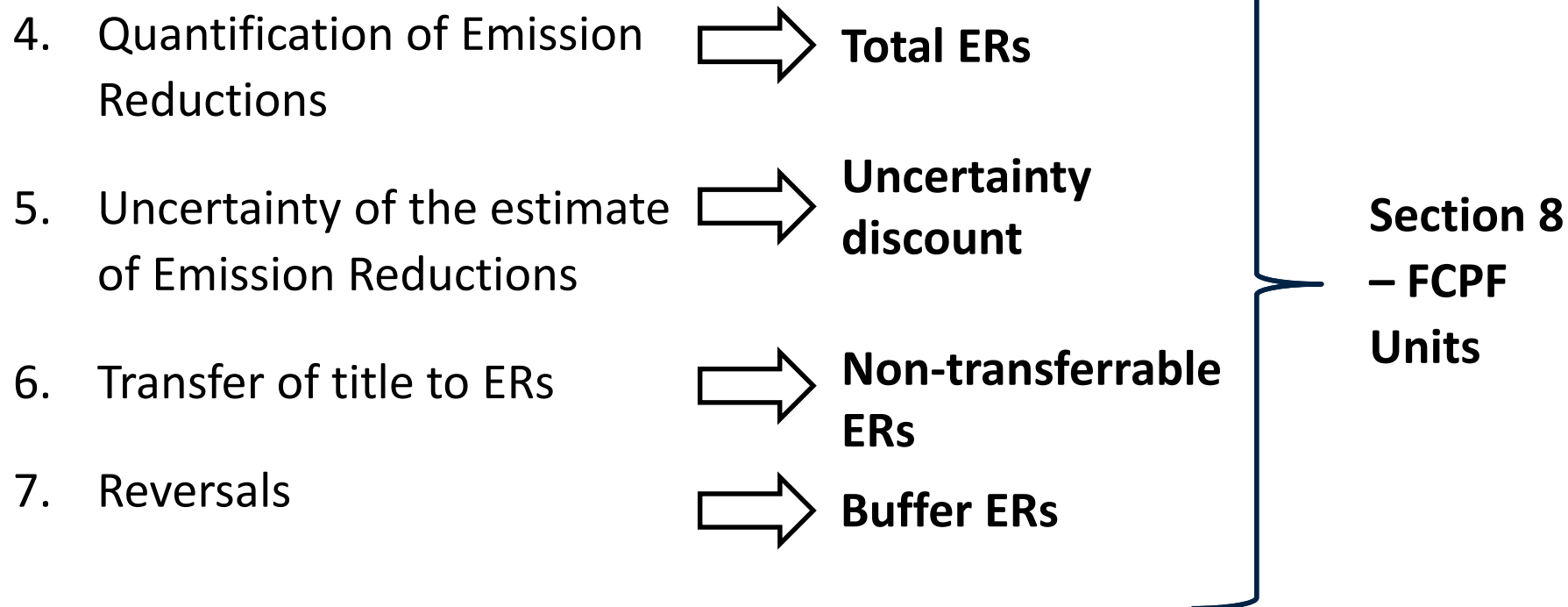
7.2 Quantification of Reversals during the Reporting Period

- Only required if reversals are reported during reporting period

7.3 Reversal risk assessment

- Required for every monitoring event
- Shall follow buffer Guidelines

8 EMISSION REDUCTIONS AVAILABLE FOR TRANSFER TO THE CARBON FUND



ANNEX 4 – REFERENCE LEVEL

- Annex 4 is compulsory whether the country applies a technical correction or not
- Annex 4 has identical structure as the ER-PD → it is an addendum to the ER-PD replacing Sections 7, 8, 9 and 12
- Section 9 provides the updated monitoring provisions that are consistent with Section 2 and Section 3 of the Monitoring Report and replaces the ‘Monitoring Plan’ of the ER-PD
- Important: Not a matter of copy-pasting ER-PD as there is improved guidance
- Objective: improve transparency to enable the partial validation of the VVB → only focuses on confirming if there are any material errors, omissions or misstatements

WHERE TO FIND THE DOCUMENTS?

Everything may be found in the FCPF website > Resources > Requirements and Templates



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Requirements

- > FCPF Methodological Framework
- > Buffer Guidelines
- > Guidelines on the application of the MF
- > Process Guidelines
- > Validation and Verification Guidelines
- > FCPF Glossary of Terms

Guidance Notes

- > Guidance note on benefit-sharing for ER programs
- > Guidance note on ability of the Program Entity to transfer title to ERs
- > Guidance Note on the Preparation of Financing Plan of ER Programs
- > Guidance Note on Disclosure of Information_2016

Templates

- > ER Program Document
- > ER Monitoring Report (English) (Spanish) (French)
- > Technical Assessment Report
- > Validation/verification Report
- > ER Program Idea Note
- > ERPA General terms & conditions
- > ERPA Commercial terms



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THANK YOU

If any clarification to the guidelines is needed please write to
fcpfsecretariat@worldbank.org

