UN-REDD
PROGRAMME

Technical considerations for Forest Reference Emission Level and/or Forest Reference Level construction for REDD+ under the UNFCCC

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The UN-REDD Programme is the United Nations collaborative initiative on Reducing Emissions from Deforestation and forest Degradation (REDD+) in developing countries. The Programme was launched in 2008 and builds on the convening role and technical expertise of the Food and Agriculture Organization of the United Nations (FAO), the United Nations Development Programme (UNDP) and the United Nations Environment Programme (UNEP). The UN-REDD Programme supports nationally-led REDD+ processes and promotes the informed and meaningful involvement of all stakeholders, including Indigenous Peoples and other forest-dependent communities, in national and international REDD+ implementation.

Technical considerations for Forest Reference Emission Level and/or Forest Reference Level construction for REDD+ under the UNFCCC

2015

Contents

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Acronym List

AD	Activity data
AGB	Above ground biomass
AT	Assessment team
BGB	Below ground biomass
BUR	Biennial update report
C	Carbon
CBM-CFS3	Carbon Budget Model of the Canadian Forest Sector
CDM	Clean Development Mechanism
CH_4	Methane
CLUE(-S)	Conversion of Land Use and its Effects (at Small regional extent)
CO_2e	Carbon Dioxide equivalent
COP	Conference of Parties to the UNFCCC
Dinamica-EGO	Dinamica Environment for Geoprocessing Objects
EF	Emission Factor
EFI-GTM	Global Forest Sector Model of the European Forest Institute
EFISCEN	European Forest Information Scenario Model
FAO	Food and Agriculture Organization of the United Nations
FCPF	Forest Carbon Partnership Facility
FREL	Forest Reference Emission Level
FRL	Forest Reference Level
G_4M	Global Forest Model of the International Institute of Applied System Analysis
GDP	Gross Domestic Product
GFOI	Global Forest Observation Initiative
GHG	Greenhouse Gas
GLOBIOM	Global Biosphere Management Model of IIASA
GOFC-GOLD	Global Observation of Forest and Land Cover Dynamics
ha	Hectares
HWP	Harvested Wood Products
HFLD	High Forest Cover, Low Deforestation Countries
IAM	Integrated Assessment Models
ICA	International Consultation and Analysis
IMAGE	Integrated Model to Assess the Global Environment of the Netherlands Environmental Assessment Agency
IPCC	Intergovernmental Panel on Climate Change
Landsat	Land Satellite (US Satellite series)
LDCs	Least Developed Countries
LULUCF	Land Use Land Use Change and Forestry
MRV	measurement, reporting and verification
$MtCO_2e$	Million tonnes of CO_2 equivalent
N_2O	Nitrous Oxide
NFI	National forest inventory
NFMS	National Forest Monitoring System
PAMs	policies and measures
QA/QC	Quality Control and Quality Assurance
RADAMBRASIL	Radar in Amazonia project which took place between 1970-1985
REDD+	Reducing emissions from deforestation and forest degradation in developing countries; and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries
RF	Removal Factor
SBI	Subsidiary Body for Implementation
SIDCs	Small Island Developing Countries
SIS	safeguard information system
TTE	technical team of experts
tCO_2e	Tonnes of CO_2 equivalent
TA	Technical assessment (of the FREL/FRL)
UNFCCC	United Nations Framework Convention on Climate Change
UN-REDD	The United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation

Executive summary

The aim of this document is to support countries seeking to develop a REDD+ Forest Reference Emission Level and/or Forest Reference Level (FREL/FRL) under the United Nations Framework Convention on Climate Change (UNFCCC). The document provides a structural overview of UNFCCC decisions related to FREL/FRLs, summarizing the guidance provided through these decisions and translating it into elements countries need to consider in a FREL/FRL submission to the UNFCCC.

The first and second part of the document puts FREL/FRLs in the context of the UNFCCC and describes the different purposes FREL/FRLs may serve. It sets out a summary of UNFCCC decisions relevant to the construction, submission and technical assessment of FREL/FRLs. It then explains the process to submit data and information used to estimate REDD+ results in the technical annex of the biennial update report (BUR), how these results relate to the FREL/FRL and what FREL/FRL information needs to be included.

The third part of the document elaborates on key elements to consider when developing a FREL/FRL, providing a description of possible advantages and risks associated with different choices for each of these elements and offering practical considerations to facilitate decision-making. Technical aspects of how to develop a FREL/FRL in line with UNFCCC guidance are discussed, recalling relevant Intergovernmental Panel on Climate Change (IPCC) guidance and guidelines and drawing from other useful guidance such as those provided by Global Forest Observation Initiative (GFOI) and Global Observation of Forest and Land Cover Dynamics (GOFC-GOLD). Other important issues relevant for the development of a FREL/FRL, such as the consistency with, and the cost-effectiveness of future measurement, reporting and verification (MRV) efforts, as well as the consideration of national REDD+ objectives are also discussed. The document stresses the usefulness of adopting a stepwise approach, enabling countries to improve their FREL/FRL over time by incorporating better data, improved methodologies and, where appropriate, additional pools.

More specifically, the document provides the following considerations for the FREL/FRL elements:

Forest definition: Implications of different thresholds of the forest definition and how they may affect forest (change) assessment are discussed.

Scope: Discussion on the selection of activities, pools and gases to include in a FREL/FRL, including the concept of significance, and consideration of national REDD+ objectives when making decisions on scope.

Scale: Discussion of the appropriate scale, or area covered by the FREL/FRL recalling that while countries should ultimately develop a national FREL/FRL, subnational FREL/FRL(s) may be elaborated as an interim measure. Considerations related to scaling up sub-national FREL/FRL(s) are also discussed.

Data selection and analysis: Examples of data sources countries may use to develop a FREL/FRL, discussion on activity data, emission factors, data uncertainties and the use of proxies, and the relationship of data and information to national forest monitoring systems and national GHG inventories are discussed.

FREL/FRL construction approach: Discussion of different methodologies to construct FREL/FRLs, for example a simple historical average or using an "adjustment", and considerations for choosing an approach based on the availability and robustness of historical data, drivers of deforestation and degradation, national circumstances, and other elements. Options for adjustments are discussed, including benefits and risks of different approaches.

At the end of each element section, a list of guiding questions is provided which should help countries in their thinking on FREL/FRL construction.

The document concludes by proposing a possible simplified flow showing how all these elements may be combined into a FREL/FRL.

1. Introduction to Forest Reference Levels in the context of REDD+

1.1 Rationale of this publication

The aim of this document is to help countries seeking to develop a REDD+ Forest Reference Emission Level and/or Forest Reference Level (FREL/FRL) under the UNFCCC. The document provides a structural overview of UNFCCC requirements for FREL/FRL construction, summarizing UNFCCC guidance and translating it into elements needed for FREL/FRL construction. A description of possible advantages and risks associated with different options for each of these elements is added to provide some practical considerations to FREL/FRL construction.

The United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation (UN-REDD) works to support the development and implementation of REDD+ activities and international consensus-building on the REDD+ process. Consistency with the UNFCCC is one of the guiding principles of the UN-REDD Programme.

This publication was preceded by a UN-REDD publication titled "Emerging approaches to Forest Reference Emission Levels and/or Forest Reference Levels for REDD+" (FAO, 2014) that provided an overview and analysis of different approaches to FREL/FRLs proposed so far by developing countries, to inform others seeking to develop FREL/FRLs for REDD+. Most approaches described therein were prepared in the context of demonstration activities.

This publication complements the approaches described. Its purpose is to present technical and procedural issues related to the construction, submission and technical assessment of FREL/FRLs in line with UNFCCC decisions. This publication is not prescriptive but rather aims to facilitate country consideration of FREL/FRLs. The document discusses options and potential implications of various choices related to FREL/FRL elements, building on the Intergovernmental Panel on Climate Change (IPCC) guidance and guidelines for National Greenhouse Gas Inventories (IPCC, 1996, 2000 and 2003) when relevant.

1.2 Forest Reference Levels for REDD+

UNFCCC decisions on REDD+[1] encourage developing countries to contribute to mitigation actions by voluntarily undertaking activities that reduce greenhouse gas (GHG) emissions and that enhance carbon sinks in the forest sector. The five activities that comprise REDD+ are[2]:

1. Reducing emissions from deforestation;
2. Reducing emissions from forest degradation;
3. Conservation of forest carbon stocks;
4. Sustainable management of forests;
5. Enhancement of forest carbon stocks.

Countries aiming to undertake REDD+ activities are requested by the UNFCCC to develop the four following elements, in the context of the provision of adequate and predictable support, including financial resources and technical and technological support to developing country Parties, in accordance with national circumstances and respective capabilities[3].

1 All REDD+ related decisions can be accessed through this link: http://unfccc.int/6917
2 UNFCCC, Decision 1/CP.16, par. 70
3 UNFCCC, Decision 1/CP.16, par. 71

Figure 1. The four key elements of REDD+ and related UNFCCC Decisions

Box 1. Relation between the four key elements of REDD+

Logically, the four elements depicted in Figure 1 are related to one-another to some extent, e.g. information that becomes available through the national forest monitoring system (NFMS) and the safeguard information system (SIS) may be used to develop or update the National Strategy or Action Plan. FREL/FRL construction may in its turn be informed by the proposed actions in the National Strategy or Action Plan.

Some relations among these four elements are 'formalized' in UNFCCC decisions, namely the relation between the NFMS and the FREL/FRL: Decision 11/CP.19 (Modalities for NFMS) states NFMS should provide data and information suitable for measuring, reporting and verifying (MRV) anthropogenic forest-related emissions by sources and removals by sinks (paragraph 3). Decision 14/CP.19 (Modalities for MRV) states MRV should maintain consistency with the established, or updated, FREL/FRL (paragraph 5). Decision 12/CP.17 decides that FREL/FRLs should maintain consistency with emissions and removals as contained in each country's GHG inventories (paragraph 8). The relation between the FREL/FRL and the National Strategy or Action Plan is not formalized. Countries can progress on these four elements as best fits its national processes and priorities, but all elements are necessary for REDD+ implementation.

All relevant UNFCCC decisions can be found in the References section.

Each of these elements has been subject to various UNFCCC decisions, as shown in Figure 1. Box 1 explains how these elements relate to one another.

The Conference of Parties (COP) to the UNFCCC has decided that forest reference emission levels and/or Forest Reference Levels (FREL/FRLs) are: *"...benchmarks for assessing each country's performance in implementing* [REDD+] *activities"*.[4]

The UNFCCC does not explicitly specify the difference between a FREL and a FRL. A common understanding is that a **FREL only includes activities which reduce emissions. Thus the scope of a FREL would be for example reducing emissions from deforestation and/or forest degradation. A FRL includes both activities which reduce emissions and activities which increase** removals[5]. Thus the scope of a FRL could include the same activities as a FREL plus for example enhancement of forest carbon stocks.

The REDD+ activities of sustainable management of forests and conservation are more difficult to categorize. Sustainable management of forests occurring on forest land remaining forest land may reduce emissions and/or increase removals. Conservation activities may be defined by certain countries as the preservation of existing carbon stocks, which in itself may not reduce emissions or increase removals. Some countries may assess that conservation activities avoid emissions or increase removals. Sustainable management of forest and conservation could therefore be included in either a FREL or a FRL, depending on how they are defined by the country.

This document uses the abbreviation "FREL/FRL" throughout the document and sometimes stand-alone Forest Reference Level as a generic term.

4 UNFCCC, Decision 12/CP.17, par. 7

5 Emissions concern the release of carbon into the atmosphere while removals concern the uptake of carbon from the atmosphere into forest carbon stocks.

Figure 2 depicts what a FREL/FRL may look like. In this example, the FREL/FRL is calculated as a simple, historical average of a given country's emissions from the forest sector based on data for the 2000-2014 period. To assess performance, emissions occurring after implementing REDD+ activities (post-2015 in this example) are compared to the FREL/FRL established by the country, and success is measured by emission reductions or increased removals relative to the FREL/FRL.

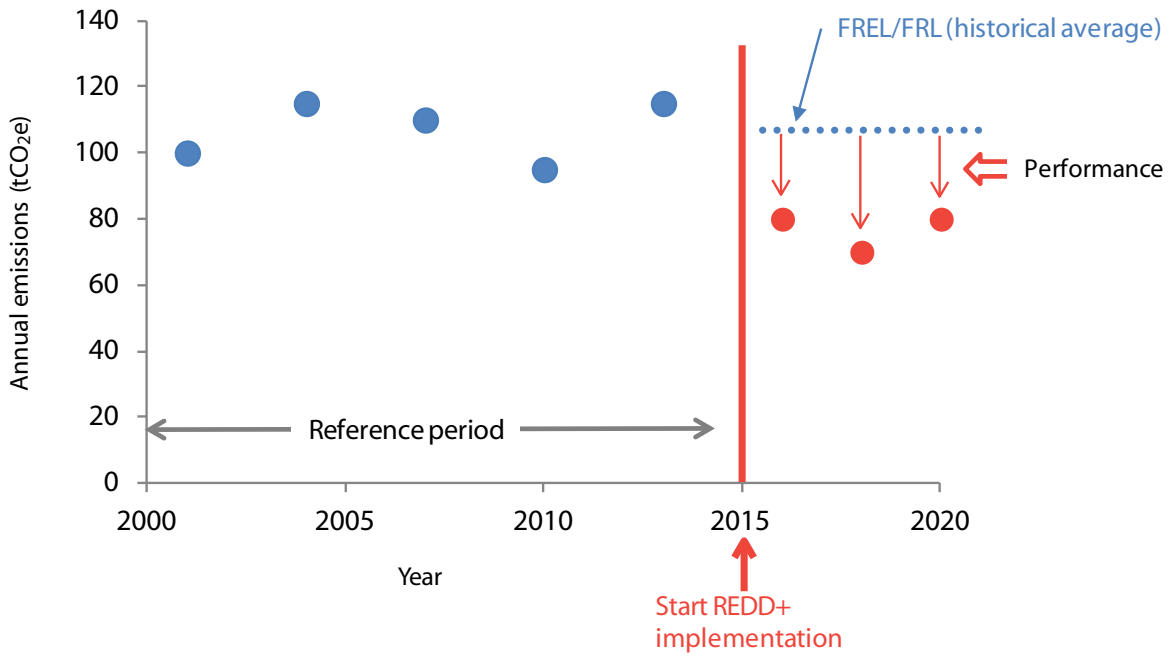

Figure 2. Example of a FREL/FRL based on average historical GHG emissions from forests

1.3 What is the purpose of Forest Reference Levels?

As agreed by the COP[6], FREL/FRLs are benchmarks for assessing each country's performance in implementing REDD+ activities. More broadly, FREL/FRLs may be relevant to assess country performance in contributing to mitigation of climate change through actions related to their forests. There could be several reasons for developing FREL/FRLs:

- Countries may wish to access results-based payments. According to UNFCCC decisions, eligibility for results-based payments require an assessed Forest Reference Level[7].
- Countries may wish to assess progress on the outcomes of the policies and measures taken to mitigate climate change in the forestry sector for domestic reasons[8].
- Countries may wish to express its contribution to international mitigation through REDD+ actions under the UNFCCC.

6 UNFCCC, Decision 12/CP.17
7 UNFCCC, Decision 9/CP.19, par. 3 and Decision 13/CP.19, par. 2
8 In the context of the UNFCCC it is not required to specifically monitor outcomes of policies and measures, but rather the results of REDD+ implementation in terms of emissions by sources and/or removals by sinks, expressed in tonnes of CO_2e.


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2. UNFCCC Guidance on Forest Reference Levels for REDD+

2.1 UNFCCC guidance

Four decisions taken by the COP provide guidance on REDD+ FREL/FRLs (Figure 3). The first decision related to FREL/FRLs (Decision 4/CP.15, paragraph 7) states that FREL/FRLs should be established *transparently, taking into account historic data, and adjust for national circumstances*. Decision 1/CP.16 includes FREL/FRLs as one of the four key elements to be developed, in the context of adequate and predictable support, by countries implementing REDD+ activities. Decision 12/CP.17 provides modalities for FREL/FRLs (or construction guidelines) and, in an annex, includes guidelines for submissions of information on FREL/FRLs to the UNFCCC. Decision 13/CP.19 provides guidelines and procedures for the technical assessment of FREL/FRLs submitted to the UNFCCC.

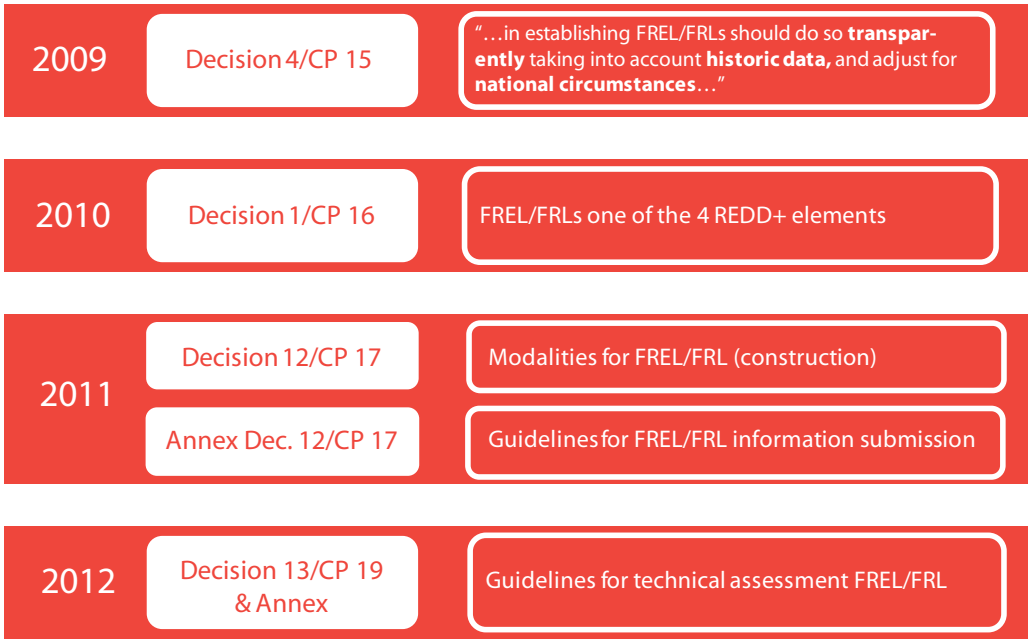


Figure 3. Chronological overview of UNFCCC decisions on FREL/FRL and summary of their contents

2.1.1 Modalities for Forest Reference Levels

UNFCCC Parties have agreed that FREL/FRLs should:

- **Be expressed in tonnes of carbon dioxide equivalent per year[9].** Other metrics, such as spatial units of forest area loss, are not acceptable as the unit to express the FREL/FRLs under the UNFCCC;
- **Take into account historical data[10].** Countries may also adjust their FREL/FRLs for national circumstances, although no detailed guidance has been provided on such adjustments;
- **Maintain consistency with national GHG inventories[11].** The FREL/FRL should be consistent with the national GHG inventory estimations[12]. Consistency with national GHG inventories also means using the IPCC guidance and guidelines[13] for both national GHG inventories as well as FREL/FRLs as a basis for estimating forest-related GHG emissions by sources and removals by sinks (GFOI, 2014);

9 UNFCCC, Decision 12/CP.17, par. 7
10 UNFCCC, Decision 4/CP.15, par. 7
11 UNFCCC, Decision 12/CP.17, par. 8
12 If data used for the FREL/FRL construction differs from that in previous submitted GHGs inventories in such a way that it is considered inconsistent, the country should consider if the future inventory will solve this problem
13 As agreed by Parties to the UNFCCC. Currently developed countries must use the 2006 guidelines. According to Annex III of Decision 2/CP.17 developing countries should use the IPCC 1996 Guidelines plus the 2000 and 2003 Good Practice Guidance. It is assumed that developing countries who wish to do so may use the IPCC 2006 Guidelines.

- **Be established transparently, providing information and rationale of FREL/FRL development**[14]**.** The information to be submitted is specified in the Annex to Decision 12/CP.17 and summarized in section 2.1.2 of this publication;
- **Recognize step-wise approaches**[15]**.** Developing countries may find it useful to improve FREL/FRLs over time by incorporating better data, improved methodologies and, when appropriate, additional pools. It also suggests countries should update their FREL/FRLs periodically to take into account new knowledge, trends or any modification of scope and methodologies;
- **Allow for the use of subnational FREL/FRLs as an interim measure**[16]**.** Countries may develop subnational FREL/FRLs as an interim measure but are expected to transition over time to a national FREL/FRL.

2.1.2 Submission of information on Forest Reference Levels

Once constructed, developing countries may, on a voluntary basis and when deemed appropriate, submit their proposed FREL/FRLs to the UNFCCC. Official submissions of the FREL/FRL to the UNFCCC are made by the national focal point to the UNFCCC. Submissions should include the following information[17]:

- **Information that was used by Parties in constructing a FREL/FRL**, including historical data and details on national circumstances[18], in a comprehensive and transparent way;
- **Transparent, complete (meaning information provided allows for reconstruction of FREL/FRL), consistent and accurate information**[19]**,** including methodological information, used at the time of construction of the FREL/FRL, including, as appropriate, a description of data sets, approaches, methods, and if applicable models and the assumptions used, descriptions of relevant policies and plans, and descriptions of changes from previously submitted information;
- **Pools, gases, and activities which have been included in the FREL/FRL** and the reasons for omitting a pool and/or activity from the construction of FREL/FRLs, noting that significant pools and/or activities should not be excluded;
- **The definition of forest used in the construction of the FREL/FRLs** and, in case there is a difference with the definition of forest used in the national GHG inventory or reporting to other international organizations, an explanation of why and how the definition used was chosen.

2.1.3 Technical assessment of Forest Reference Levels

Parties seeking to obtain results-based payments for REDD+ activities need to submit a FREL/FRL, which shall be subject to a technical assessment[20]. Procedures for the technical assessment of FREL/FRLs were agreed upon at COP 19 in Warsaw[21].

The objectives of the FREL/FRLs technical assessment are: (1) to assess the degree to which the information provided meets the UNFCCC guidelines for submission of information on FREL/FRLs; and (2) to offer a facilitative, non-intrusive, technical exchange of information on the construction of FREL/FRLs. The latter is also seen as an opportunity to facilitate capacity building on FREL/FRL construction.

The **scope** of the technical assessment of data, methodologies and procedures, i.e. the elements that will be technically assessed by the Land Use Land Use Change and Forestry (LULUCF) experts, includes the following:

- The extent to which the FREL/FRLs maintain consistency with previous GHG inventory submissions on forest related anthropogenic GHG emissions by sources and removals by sinks;
- How historical data have been considered during the establishment of the FREL/FRLs;
- The extent to which the information provided is transparent, complete, consistent and accurate;
- Whether a description of relevant policies or plans has been provided;
- Whether a description of changes made from previous FREL/FRL submissions has been provided (if countries modify their FREL/FRLs over time);
- Pools, gases and activities included in the FREL/FRLs, including justification of why excluded pools and/or activities were not deemed significant;

14 UNFCCC, Decision 4/CP.15, par. 7 and Decision 12/CP.17, par. 9
15 UNFCCC, Decision 12/CP.17, par. 10 and 12
16 UNFCCC, Decision 12/CP.17, par. 11
17 Found in the Annex to Decision 12/CP.17
18 UNFCCC, Decision 12/CP.17, par. 9
19 UNFCCC, Annex to Decision 12/CP.17
20 UNFCCC, Decision 13/CP.19, par. 1 & 2
21 UNFCCC, Decision 13/CP19

- If a forest definition is provided and, if different from other definitions previously used in the GHG inventory or reported to other international organizations, why and how the definition used was chosen;
- Whether assumptions about future changes expected to domestic policies have been included in the construction of the FREL/FRLs;
- The extent to which the FREL/FRL value is consistent with the supporting information and descriptions provided by the Party.

The technical assessment process may identify areas for technical improvement of future FREL/FRLs. These areas for improvement and the capacity building needs for the construction of future FREL/FRLs may be noted by the Party concerned. The technical assessment shall refrain from making judgment on domestic policies included in FREL/FRLs. It concerns an internal exchange between the Party and the technical assessment team. Only when the report from the technical assessment is finalized it is posted on the UNFCCC website together with the modified FREL/FRL submission.

Regarding **procedures** of the technical assessment, the UNFCCC Secretariat will coordinate the technical assessment and assign the experts who will undertake it. The technical assessment shall be undertaken by two LULUCF experts from the UNFCCC's Roster of Experts, including one from a developed country and one from a developing country. The Consultative Group of Experts on National Communications from Parties not included in the Annex I of the Convention may nominate one of its experts from a developing country to participate as an observer.

An assessment session will be organized once a year in Bonn, Germany. Only submissions sent at least 10 weeks in advance of the assessment session will be considered in a particular session. The technical assessment process could require up to 42 weeks (counted from the moment of submission by the Party)[22]. Prior to the assessment session, the assessment team should identify any preliminary issues requiring clarification from the Party. During the assessment, the Party may interact with the assessment team to clarify any relevant issue or to provide additional information.

The figure below depicts the steps and timeline that characterize the FREL/FRLs technical assessment process:

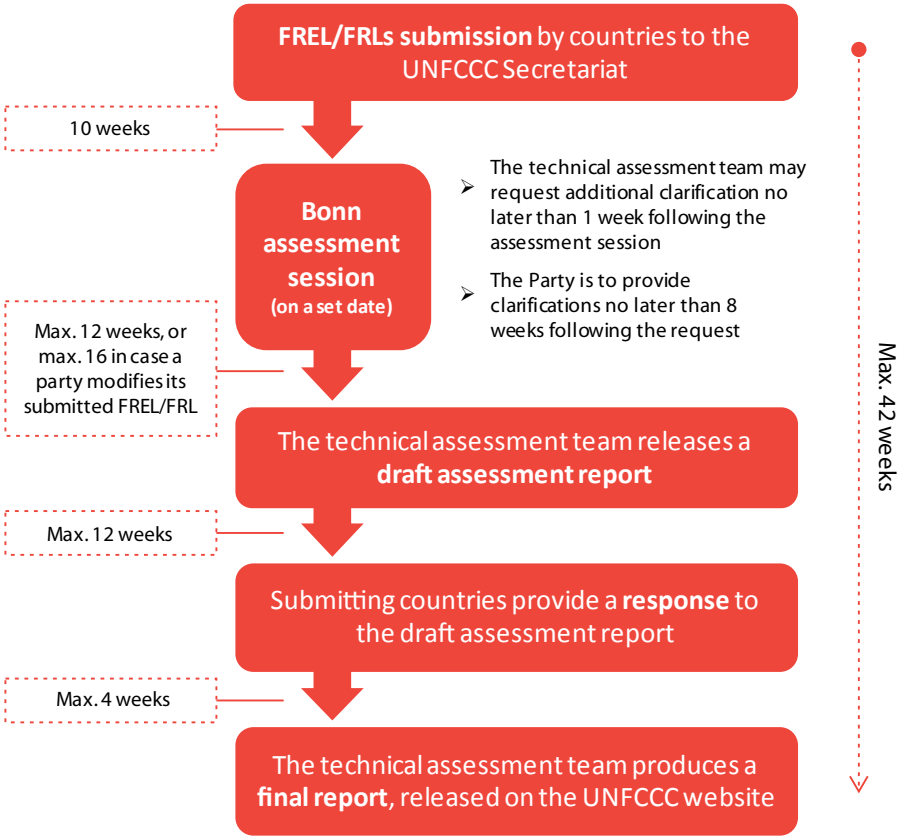


Figure 4. UNFCCC technical assessment process and timeline for FREL/FRLs

22 http://unfccc.int/files/parties_and_observers/notifications/application/pdf/message_to_parties_reference_levels.pdf

2.1.4 *Submission of results and Forest Reference Level information in Biennial Update Reports*

Once its FREL/FRL has been technically assessed, a developing country seeking results-based payments from REDD+ activities is requested to submit a technical annex[23] to its Biennial Update Report (BUR) with the following information[24]:

- Summary information from the final report containing each assessed FREL/FRL and including:
  - The technically assessed FREL/FRL
  - The REDD+ activity or activities included in the FREL/FRL
  - The territorial forest area covered
  - The date of the FREL/FRL submission and date of the final technical assessment report
  - The period covered, in years, by the assessed FREL/FRL
- Results in tonnes of CO_2 equivalent per year during the period chosen for results-based payments, consistent with the assessed FREL/FRL;
- Demonstration that the methodologies used to produce the results are consistent with those used to establish the FREL/FRL;
- A description of National Forest Monitoring Systems (NFMS) and the institutional roles and responsibilities for measuring, reporting and verifying the results;
- Necessary information that allows for the reconstruction of the results;
- A description of how the elements in decision 4/CP.15, paragraph 1(c)[25] and (d)[26], have been taken into account.

It is worth noting that developing countries are required to submit a BUR every two years, with the exception of Least Developed Countries (LDCs) and Small Island Developing Countries (SIDCs), which can submit their BUR at their own discretion.

The BUR, including any additional technical information will be subjected to the International Consultation and Analysis (ICA), which consists of two steps: a technical analysis and a facilitative sharing of views. The ICA is conducted by a technical team of experts (TTE) under the Subsidiary Body for Implementation (SBI) auspices and aims to increase the transparency of developing countries' mitigation actions and their effects. The information considered under the technical analysis of the ICA includes, amongst others, information on mitigation actions, methodologies and assumptions and an analysis of the impacts of the mitigation actions.

If a technical annex on REDD+ activities is supplied in the BUR in order to seek result-based payments, the TTE may include two LULUCF experts upon request of the developing countries submitting the BUR. In such case, the technical analysis of the BUR will include an analysis of the accuracy of the results from the implementation of REDD+ activities, to the extent possible. The TTE will also analyze the consistency in methodologies, definitions, comprehensiveness and the information provided between the reported results and the assessed FREL/FRL.[27]

23 UNFCCC, Decision 14/CP.19, paragraph 7
24 UNFCCC, Annex of Decision 14/CP.19
25 To use the most recent IPCC guidance and guidelines, as adopted or encouraged by the CP, as appropriate, as a basis for estimating anthropogenic forest-related GHG emissions by sources and removals by sinks, forest carbon stocks and forest area changes.
26 To establish, according to national circumstances and capabilities, robust and transparent national forest monitoring systems and, if appropriate, sub-national systems as part of national monitoring systems that:
(i) Use a combination of remote sensing and ground-based forest carbon inventory approaches for estimating, as appropriate, anthropogenic forest-related greenhouse gas emissions by sources and removals by sinks, forest carbon stocks and forest area changes;
(ii) Provide estimates that are transparent, consistent, as far as possible accurate, and that reduce uncertainties, taking into account national capabilities and capacities;
(iii) Are transparent and their results are available and suitable for review as agreed by the CP;
27 UNFCCC, Decision 14/CP.19, par. 11, and Decision 2/CP.17, Annex IV.

3. Technical aspects and considerations for Forest Reference Levels

3.1 Elements of Forest Reference Levels

Developing a FREL/FRL is not a stand-alone exercise but, as explained previously in Box 1, is linked to a country's National Forest Monitoring System (NFMS)[28] and the data and information it provides for measuring, reporting and verifying (MRV)[29] anthropogenic forest-related emissions by sources and removals by sinks. Countries are expected to use their NFMS to assess results from REDD+ implementation and report their emissions and removals from the forest sector in their national GHG inventories[30]. FREL/FRLs are benchmarks used to assess performance from REDD+ implementation: Performance is assessed by comparing emission estimates after REDD+ implementation with the FREL/FRL(s). Therefore maintaining consistency (in methodologies, definitions, comprehensiveness and the information provided) between emission estimates and the FREL/FRL is essential to measure performance[31] as illustrated by Figure 5. A lack of consistency may compromise the assessment of performance.

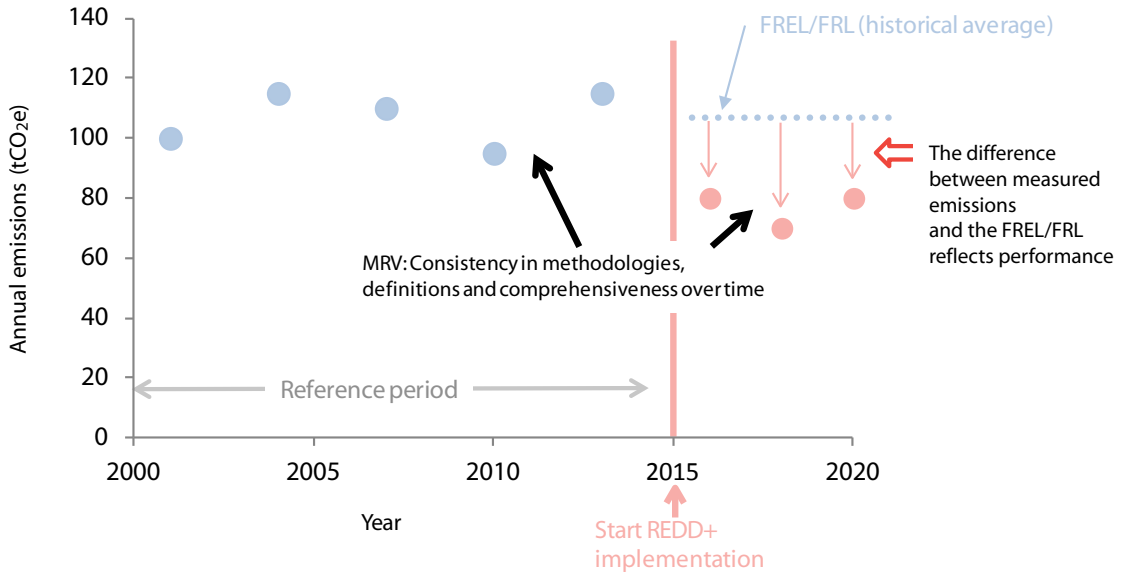


Figure 5. Forest reference level example illustrating performance assessed by comparing emissions measured post-REDD+ implementation against the FRL and illustrating the importance of consistency in measurements over time (in terms of methodology, definitions and comprehensiveness).

Countries may have developed or have access to historical assessments of forest area change for their country, which could be from national, regional and/or global datasets. Likewise, countries may have already produced and submitted national GHG inventories to the UNFCCC including estimates for their forestry sector. Depending on what data is available, countries may want to first analyze existing historical data when constructing their FREL/FRLs and assess its relevance in this context.

28 UN-REDD provides guidance on NFMS and MRV in the following document:
http://www.unredd.net/index.php?option=com_docman&task=doc_download&gid=10305&Itemid=53
29 UNFCCC, Decisions 11/CP.19/par. 3 (modalities for NFMS) *decides that NFMS should provide data that is transparent, consistent over time and are suitable for MRV.*
30 UNFCCC, Decision 13/CP 19/Annex/par. 2(a) says that the technical assessment of the FREL/FRL will evaluate *the extent to which the FREL/FRL maintains consistency with corresponding anthropogenic forest-related greenhouse gas emissions by sources and removals by sinks as contained in the national GHG inventories.*
31 UNFCCC, Decision 14/CP.19, par. 11(a) (modalities for MRV) *There is consistency in methodologies, definitions, comprehensiveness and the information provided between the assessed reference level and the results of the implementation of the activities referred to in Decision 1/CP.16, p70* [REDD+].

According to the UNFCCC's FREL/FRL modalities, guidelines for submission of information and guidelines for the technical assessment of submissions, the following key elements need to be considered by countries when developing FREL/FRLs:

- **Forest definition:** The forest definition used for the construction of the FREL/FRL[32];
- **Data:** How historical data have been taken into account[33];
- **Scope:** REDD+ activities, pools and gases included in the FREL/FRL[34];
- **FREL/FRL construction approach:** Parties are invited to submit information and rationale on the development of their FREL/FRL[35]. These include details on national circumstances and how these are considered if adjustments are made[36];
- **Scale:** The area covered by the FREL/FRL, with due consideration to the development of sub-national FREL/FRLs as an interim measure[37].

Because of the strong relationship between a country's NFMS and its FREL/FRL, many decisions related to elements mentioned above will be based upon data gathered by the NFMS. For instance, the forest definition used for the FREL/FRL is likely to be adopted when establishing the NFMS. Likewise, the data sets and methods used to calculate emission factors or track land-use change for the FREL/FRL should be consistent with those reported from the NFMS (in the GHG inventory). Furthermore, decisions on these elements may be informed by a country's National Strategy or Action Plan if deemed appropriate by the country.

The following section analyzes some of the main technical issues that countries may want to consider before taking decisions on the construction of their FREL/FRLs. Although countries have to make initial decisions on these various FREL/FRL elements, these can be developed and improved over time under the stepwise approach recognized by the COP.

3.1.1 Forest definition

When submitting a FREL/FRL to the UNFCCC, countries should provide the definition of forest used in the construction of FREL/FRLs.

Consistency with national GHG inventory and consistency over time

The extent to which the FREL/FRL maintains consistency with national GHG inventories will be examined during the technical assessment of the FREL/FRL[38]. Countries will need first to assess what forest definition has been used in previous national GHG inventories or in reporting to other international organizations. If the country decides to use a different forest definition for FREL/FRL construction, it must provide an explanation of why and how the definition used was chosen. The forest definition should remain consistent over time to ensure that changes detected between forest area assessments over time reflect real changes.

Effect of forest definition thresholds

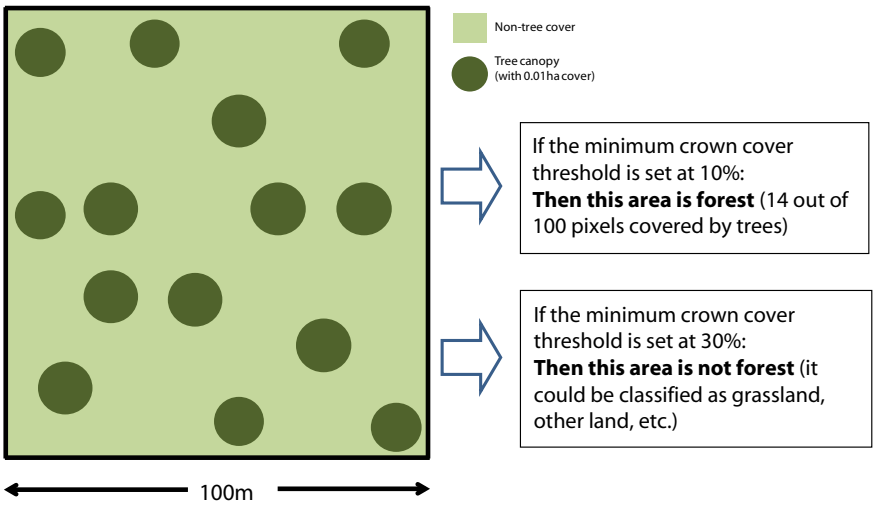
The IPCC guidance (IPCC, 2006) on land representation for reporting in the national GHG inventory provides a description for forest land[39] which states it includes all land with woody vegetation consistent with thresholds used to define forest land in the national GHG inventory. The thresholds referred to in the IPCC description of forest land concern:

- Minimum crown cover (expressed in percentage)
- Minimum tree height (expressed in meters),
- Minimum area (expressed in hectares).

Particular ranges for these thresholds have been provided for Annex I Parties through the Marrakesh accords[40] but these do not necessarily apply for developing countries (unless they established a forest definition to participate in the Clean Development Mechanism, CDM, through the implementation of afforestation/reforestation projects).

32 UNFCCC, Decision 13/CP.19, Annex, par. 2 (g)
33 UNFCCC, Decision 4/CP.15/par. 7; Decision 13/CP.19, Annex, par. 2 (b, c)
34 UNFCCC, Decision 12/CP.17, par. 10; Decision 13/CP.19, Annex, par. 2 (f)
35 UNFCCC, Decision 12/CP. 17, II, par. 9; Decision 13/CP.19, Annex, par. 2 (c)
36 UNFCCC, Decision 4/CP.15/par. 7; Decision 12/CP.17, par. 9; Decision 13/CP.19, Annex, par. 2 (d)
37 UNFCCC, Decision 12/CP.17, par. 11; Decision 13/CP.19, Annex, par. 2 (c)
38 UNFCCC, Decision 13/CP.19, Annex, par. 2a
39 (i) Forest Land: This category includes all land with woody vegetation consistent with thresholds used to define Forest Land in the national greenhouse gas inventory. It also includes systems with a vegetation structure that currently fall below, but in situ could potentially reach the threshold values used by a country to define the Forest Land category.
40 "Forest: is a minimum area of land of 0.05 – 1.0 ha with tree crown cover (or equivalent stocking level) of more than 10-30% with trees with the potential to reach a minimum height 2 – 5 m at maturity in situ. A forest may consist of either closed formations where trees of various story and undergrowth cover a high proportion of the ground or open forest. Young natural stands and all plantations which have yet to reach a crown density of 10-30% or tree height of 2 – 5 m are included under forest, as are areas normally forming part of the forest area which are temporarily un-stocked as a result of human intervention such as harvesting or natural causes, but which are expected to revert to forest".

The existing or potential threshold selection may be informed by the predominant forest type in the country (e.g. dry forest typically has a more open crown cover and may frequently have a cover <30%) or other country specific reasons (e.g. socio-economic importance, environmental value, etc.).



The thresholds in the national forest definition may impact the assessment of forest area, the assessment of forest area change and the identification of nationally-appropriate REDD+ activities to implement. Figure 6 illustrates how the assessment of forest area in a country may change with the choice of the minimum crown cover threshold in the forest definition.

Figure 6. Illustration of how the forest area assessment is affected by the choice of forest crown cover: In this particular example, a 10% crown cover threshold would encompass a larger forest area in a country's REDD+ programme than a 30% threshold.

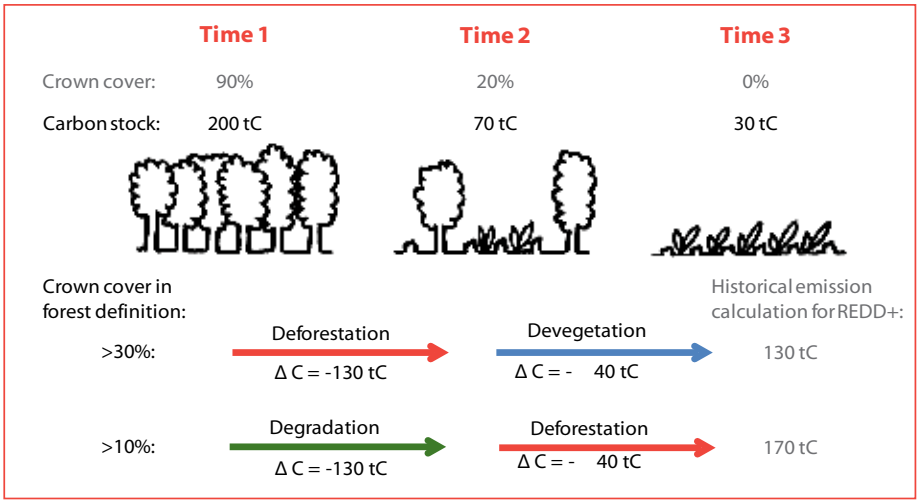


Figure 7. Illustration of how different cover thresholds for the forest definition may impact historical emission estimations from deforestation and forest degradation (modified from Walker *et al*, 2013)

Figure 7 illustrates a given forest losing carbon stocks over time (three time points are shown). The Figure shows how the same emissions can be identified as resulting from either deforestation, forest degradation or neither (i.e. devegetation) based on the minimum crown cover threshold chosen by a country. In the example, emissions occurring between Time 2 and Time 3 would be either included or excluded from emission calculations under a country's REDD+ programme depending on the minimum crown cover threshold chosen in the forest definition (and the activities chosen to include in the FREL/FRL).

Figure 8 illustrates how the selection of the minimum area threshold can affect both the assessment of forest area (Figure 8a) and forest area change (Figure 8b). In Figure 8a, a country would identify certain areas of its lands differently depending on its choice of minimum area. In Figure 8b, the selection of a larger minimum area (one hectare in this case) would not allow a country to identify some of the smaller scale forest loss (Figure 8b) as deforestation, though it may identify it as degradation. On the other hand, there may be technical challenges associated with detecting very small forest areas and monitoring changes within them and countries need to consider trade-offs associated with national capabilities. For instance, choosing a minimum area of 0.1 ha (~ equal to one Landsat pixel) can significantly increase the work required (for data processing of remotely sensed data, acquisition of ground data, or both) to provide estimates of forest area and estimates of change with low standard errors. It may therefore be useful to consider the significance of the additional emissions and removals captured against the level of effort required to measure them.

Illustration of how the choice of minimum area affects:

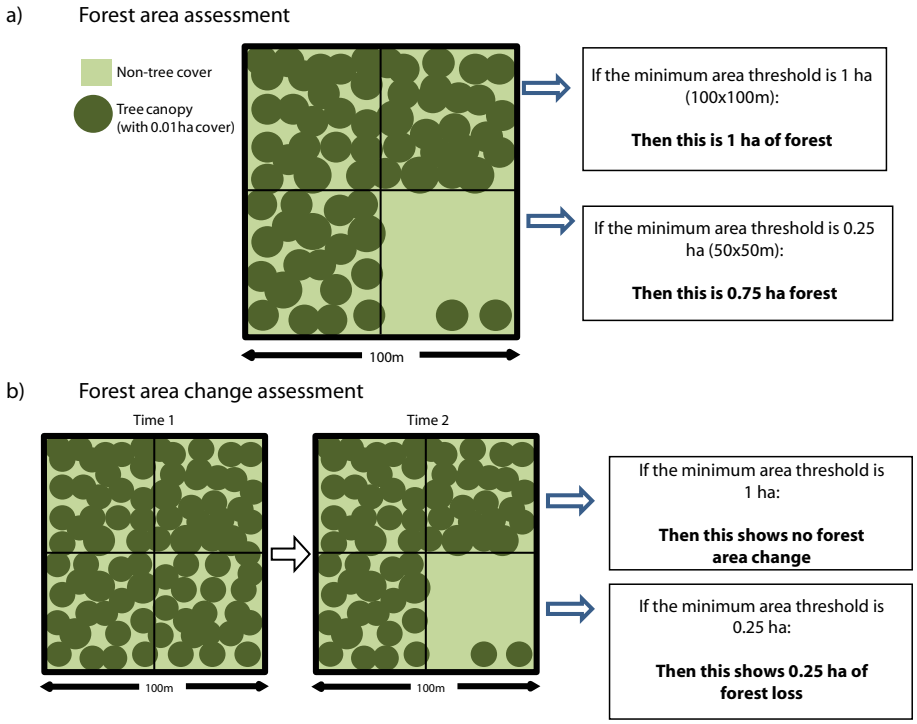


Figure 8. Illustration of how a forest area assessment and forest area change assessment may yield different results for the same situation with different choices of minimum area in the forest definition. The example assumes the minimum crown cover threshold in the forest definition not to be below 10%.

In summary, countries have to balance the possible trade-offs of threshold effects. Additional considerations for deciding on a forest definition are provided in (FAO, 2006).

Considerations when choosing a forest definition for REDD+

Countries need to establish whether a national definition already exists, what definition was used for their GHG inventory and whether they wish to justify diverting from it under REDD+. Countries may already have a legal definition of forest on which they can build. Important considerations are the availability or access to consistent and comparable data over time and the capacity to monitor changes in small patches of forest, particularly through remote sensing. The choice of thresholds may be influenced by the type and quality of historical data used to construct FREL/FRLs, which may often be of lower resolution and might not be well suited, for example, for a very small minimum area threshold. In addition, it is important to keep in mind Decision 13/CP.17, paragraph 11(a), which reminds countries that whatever methodologies and definition are chosen for the FREL/FRL construction, future assessments should be consistent with these choices.

Forest definition guiding questions

- ✓ What forest definition is used for national GHG inventories (past submissions to the UNFCCC and any currently in preparation)?
- ✓ What other definitions are in use, either domestically or in reporting to other international organizations?
- ✓ Which definition is the most appropriate for your country's FREL/FRL in the context of REDD+? If not the same as those above, can the difference be justified and explained?
- ✓ Does data availability, acquisition cost and processing capacity allow for an accurate and consistent assessment of land use and land-use change based on the proposed thresholds of the forest definition?

3.1.2 Scope: activities, pools and gases to be included

When submitting FREL/FRLs and reporting on REDD+ results to the UNFCCC, countries are required to indicate its scope i.e. which REDD+ activities, pools and gases are included in the FREL/FRL (see Table 1 for complete lists of these).

Table 1. List of activities, pools and gases to assess the scope of FREL/FRLs

Activities	Pools	Gases
• Reducing emissions from deforestation • Reducing emissions from forest degradation • Conservation of forest carbon stocks • Sustainable management of forests • Enhancement of forest carbon stocks	• Above-ground Biomass • Below-ground Biomass • Soil • Litter • Dead wood • (Harvested Wood Products)[a]	• CO_2 • CH_4 • N_2O

a Developing countries are not required to report on Harvested Wood Products under REDD+, which was a pool included for the second commitment period of the Kyoto Protocol for Annex I countries. Reporting rules are complex for HWP and data requirements high.

Countries may take a step-wise approach to the development of FREL/FRLs, improving them over time by incorporating better data, improved methodologies and additional pools[41]. Significant pools and/or activities should not be excluded[42] from the scope of the FREL/FRLs If countries omit certain REDD+ activities or pools because they are deemed not significant, a justification needs to be provided.

Selection of activities

The selection of activities considered in the FREL/FRL should be based on their associated emissions in the past. Data availability, data reliability or lack of resources to collect the necessary data may form additional considerations for the selection of activities in the early development of FREL/FRLs.

The selection of activities in the FREL/FRL may ultimately be closely linked with a country's REDD+ objectives (the National Strategy or Action Plan). Aside from including significant REDD+ activities, a country may select additional activities based on its ability to reduce emissions or enhance carbon stocks. A recent UN-REDD publication describing the approach to FREL/FRL construction taken by 10 countries (FAO 2014) shows that many countries are considering the inclusion of the activity "enhancement of forest carbon stocks" in their Forest Reference Level, not because it has historically been a significant source of removals from the forestry sector, but because of the expected sequestration potential.

Selection of pools

According to the UNFCCC, significant pools should not be excluded from FREL/FRLs[43]. The UNFCCC does not provide a definition of significant. IPCC (2003) does mention a threshold for significant though only for pools or gases[44] and in the context of deciding whether Tier 1 suffices or higher Tiers are suggested for its estimation, not in the context of omitting the pool.

It is worth noting that the notion of significance applies when assessing emissions/removals (i.e. fluxes or changes in carbon stocks), and not when assessing carbon stocks per pool. As an example, a country may be tempted to include its soil organic carbon pool because it represents a relatively large forest carbon stock compared to the four other forest carbon pools. However, if the soil organic carbon pool is not subject to large variations from one reporting period to the next, it may not be significant in terms of associated emissions.

Countries should therefore attempt to understand carbon stock dynamics in the five pools relevant to REDD+ activities to make an informed decision on which pools can be excluded or which pools, if data is not available, may require more attention in future improvements. Once these dynamics are understood, a country may decide whether or not the pool is considered significant.

Ultimately, countries may decide to include additional pools that are not necessarily significant but important because of their own national objectives. For instance, a country may be interested in including the soil organic carbon pool in its FREL/FRL because it wishes to better monitor change as well as the impacts of certain policies and measures (PAMs) that may increase this pool significantly in the future.

41 UNFCCC, Decision 12/CP 17
42 UNFCCC, Decision 12/CP.17, Annex (c)
43 UNFCCC, Decision 12/CP.17, Annex (c)
44 The IPCC 2003 GPG notes that in the context of estimating emissions and removals, a sub-category (a pool or gas) is deemed significant if it accounts for at least 25-30% of emissions/removals for the overall category.

Box 2. Brazil's FREL submission to UNFCCC

In June 2014, Brazil became the first country to submit a FREL to UNFCCC. Before the end of 2014, Brazil submitted a modified FREL submission providing more detailed information in response to the facilitative, technical exchange with the Technical Assessment team (AT). The Technical Assessment report (TA report) was posted on the UNFCCC website[a] (Brazil, 2014).

Stepwise approach: The evolution from Brazil's deforestation *baseline*[b] used in the Amazon Fund to the FREL submitted to the UNFCCC could be considered an illustration of a stepwise approach. The pools considered in the FREL expanded compared to the Amazon Fund approach (see FAO 2014) and more detailed information was used for Emission Factor estimations. In its *baseline* calculation, the Amazon Fund first adopted a conservative estimate of 100 tC/ha for above ground biomass (data in literature ranged from 130 and 320 tC/ha). For the subsequent UNFCCC submission, a carbon map was produced resulting in multiple forest types and location-specific emission factors. Brazil's FREL submission states that over time it will include additional activities such as degradation, as well as other biomes beyond the Amazon, as steps towards development of a national level FREL.

REDD+ activities included: The FREL only includes deforestation of primary forest, where Brazil considers deforestation any clear cut of primary forest with a minimum mapping unit of 6.25 ha. The reason provided by Brazil for including only deforestation is that this activity represents the largest source of emissions and the time series available for assessing degradation is too short to allow an adequate understanding of the degradation process. In an Annex to the submission (not subject to the technical assessment), Brazil provides preliminary results of the assessment of degradation, which estimates emissions from degradation at approximately 59% of those from deforestation. In the TA report the AT acknowledges that Brazil included the most significant activity, the most important biome and the most significant pools in terms of emissions from forests. Furthermore, the AT considers that degradation is a significant activity based on the estimates provided by Brazil. The AT also notes that there is no evidence of displacement of emissions (i.e. decreased deforestation in the Amazonia biome resulting in increased degradation) and the current exclusion appears to be conservative in the context of constructing the FREL.

Future submissions and areas for improvement: Brazil indicates its intention to scale up to the national level in the future, developing FRELs for the remaining biomes in order of emissions importance. Brazil also expects that it's understanding of degradation will improve with time as new data becomes available, allowing for the future submission of a FREL for degradation. Brazil mentions in its submission some areas for improvement. E.g. currently the carbon map is based on a combination of sample-plot data (RADAMBRASIL) and literature. Brazil will replace this with data from its first NFI cycle as it expects that by 2017 the NFI will be completed in all states.

Areas for improvement identified by the AT are digitization of deforestation maps (activity data for 1996-1997 are in analogue format, later dates in digital format), continuation of improvement of the carbon map, future treatment of emission from dead-wood and non-CO2 to be consistent with the GHG inventory (where the AT notes that the current omission is likely to be conservative) and future treatment of degradation.

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a UNFCCC FREL/FRL submissions and technical assessment reports to date can be downloaded from http://unfccc.int/methods/redd/items/8414txt.php

b Brazil uses the term baseline for the Amazon Fund, the term FREL refers to Brazil's UNFCCC submission

Selection of gases

On the inclusion of gases, Decision 12/CP.17, Annex (c) suggests that any omission of significant activities or pools should be justified, but does not mention gases. Concerning the inclusion or omission of gases, countries should try to maintain consistency with their GHG inventory and should provide a justification for omissions. A country may propose to include fewer gases in the FREL/FRL than included in the GHG inventory, because they may not have detailed or disaggregated enough information for the REDD+ activity in the FREL/FRL.

Scope guiding questions

- ✓ Were deforestation or forest degradation significant contributors to forest emissions in the historical period used for the FREL/FRLs?
- ✓ Which REDD+ activities offer the greatest mitigation potential in the forestry sector?
- ✓ Are increased emissions expected from omitted activities in the future? If so, would this be a result of emission reductions from the activities included in the FREL/FRL (displacement of emissions)?
- ✓ Is the omission of a pool/gas/activity conservative, i.e. are emissions from the omitted pool/gas/activity expected to decrease with REDD+ implementation?
- ✓ Are there other national objectives that favor the inclusion of certain activities, pools or gases that are not key contributors to emissions in the forestry sector?
- ✓ Can emission reduction estimates for the significant REDD+ activities included in the FREL/FRL be produced with reasonable accuracy?
- ✓ Which carbon pools and gases are subject to significant change in these significant activities?
- ✓ Can estimates for these significant pools and gases be produced with a reasonable accuracy? If not, can an estimate be produced even with high uncertainty?
- ✓ What future improvements could be made as part of a stepwise approach?
- ✓ Are the REDD+ activities considered in the national strategy included in the scope of the FREL/FRL?

Avoiding over- or under-estimations of emissions and removals

In reporting, GHG inventories should apply the IPCC good practice principle of neither over-nor under-estimating emissions and removals. In the context of results-based payments (e.g. for the FREL/FRL), however, when accurate estimates cannot be achieved, a country could provide an estimate which does not overestimate emission reductions, or at least reduces the risk of overestimation (Grassi *et al*, 2008). Suggestions are made for countries with limited data or capacities on how to prepare conservative estimates in (Federici *et al*, 2012; Grassi *et al*, 2013).

3.1.3 Scale

While REDD+ is intended to be implemented at national level, participating REDD+ countries may elaborate sub-national FREL/FRLs as an interim measure[45]. Starting at a sub-national scale may help countries test approaches and tools, and may allow them to pilot REDD+ activities and assess their performance against the proposed sub-national FREL/FRLs.

Several examples of approaches of subnational FREL/FRLs exist (most for demonstration activities) and have recently been the subject of a UN-REDD publication (FAO 2014). The scales chosen for these demonstration activities tend to be greater than1 million hectares consisting of one or several administrative units (province, district, etc.) or ecological zones (biome or eco-regions characterized by forest type and/or climatological conditions). Setting of the scale (for example, administrative unit, biome, etc.) could be influenced by the drivers of deforestation and forest degradation, the actions a country plans to undertake to tackle them (i.e. the National Strategy or Action Plan), or by the administrative arrangements of a country. The size of the country may be a critical factor when selecting the scale, e.g. the subnational area of a large country may exceed the size of a small country. FREL/FRL scale considerations may also be related to the desire of a country to link performance to benefit sharing below the national level. However, benefit sharing is a domestic issue on which no details need to be provided in a FREL/FRL submission. Benefit sharing goes beyond the scope of this publication.

A national FREL/FRL could be a combination of sub-national FREL/FRLs[46]. Having one overall national FREL/FRL will tend to reduce cost related to calculating and updating the FREL/FRL and increase consistency in the way different activities are estimated. Whether a country submits one national FREL/FRL, one subnational FREL/FRL or an aggregation of sub-national FREL/FRLs in the context of the UNFCCC may depend on, for example, the National Strategy or Action Plan, as well as data availability and/or quality.

A country may also have other FREL/FRLs that were not designed for a UNFCCC submission to meet different national objectives or purposes (as discussed in Section 1.3). For example, a country may develop FREL/FRLs for demonstration activities, as a way to inform the UNFCCC FREL/FRL through learning-by-doing. In some cases, FREL/FRLs of demonstration activities may not always be fully consistent with FREL/FRLs submitted in the context of the UNFCCC. In this case, a country may want to explain how these different FREL/FRLs relate.

National and sub-national FREL/FRL development

A country has different scale options for developing its FREL/FRL. One option, called "national-level development" in this publication (Figure 9), is to develop a national Forest Reference Level using data with national coverage and one FREL/FRL construction approach.

As indicated in Figure 9, the national FREL/FRL may be disaggregated into subnational components. Disaggregation may help countries develop several sub-national FREL/FRLs that are consistent in approach, scope and data used, and could be used for instance, to track performance by administrative units or eco-zones.

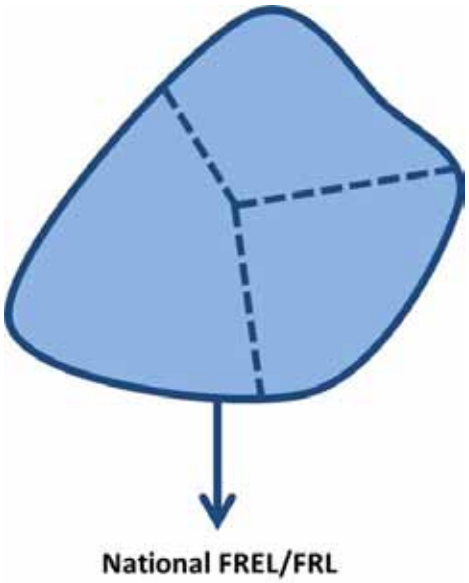


Figure 9. National level development: One national FREL/FRL using a single construction approach, which may be disaggregated into subnational components

45 UNFCCC, Decision 12/CP.17, par. 11

46 Footnote to Decision 1/CP.16, paragraph 71(b)

Countries may also develop multiple sub-national FREL/FRLs (either simultaneously or at different points in time) using sub-national methodologies and data, and subsequently aggregate them to create a single national FREL/FRL. This approach, referred to as "subnational development", is depicted in Figure 10.

The subnational development of FREL/FRLs may provide more flexibility at the subnational level to choose the approach, scope and data which better responds to the local situation. For example, an administrative unit which has more detailed data collected through an on-going subnational programme or initiative could use this detailed data rather than more coarse national data. It may also allow a subnational unit to include a REDD+ activity for which data are insufficient at the national scale (e.g. it could monitor degradation using high-resolution imagery).

However, countries may be challenged to maintain consistency among different sub-national FREL/FRLs when using such a design, particularly when they are developed by different actors and when coordination on FREL/FRL issues is lacking. For instance, one sub-national FREL/FRL may use different emission factors than another sub-national FREL/FRL (e.g. for the same land-use type or forest strata) or different methods to generate activity data. In case these differences in approach are not reflected in the GHG inventory there would be an issue of consistency between the FREL/FRL and the GHG inventory.

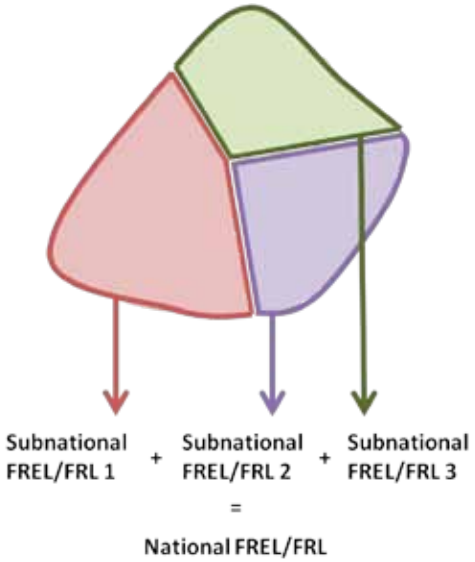


Figure 10. Subnational development: National FREL/FRL is an aggregation of several FREL/FRLs for subnational components, differences may exist in approach, data and scope of each of the subnational FREL/FRLs

When considering choices related to scale, countries may want to consider consistency between the scale of their forest monitoring and/or forest management practices/units. For instance, countries with decentralized forest monitoring systems may want to consider developing their national Forest Reference Level by gathering data from their decentralized administration, thus opting for a subnational approach. Conversely a country with a highly centralized forest monitoring system with limited accuracy at a smaller scale may find it challenging to monitor the results for several sub-national FREL/FRLs covering relatively small areas of its territory.

Project level activities

Various actors may already be implementing projects with their own Forest Reference Levels (sometimes referred to as "baselines") which may be inconsistent with the national or subnational FREL/FRL under the UNFCCC because they use different data, a different construction approach and/or have a different scope. Carbon credits may have been sold for such projects.

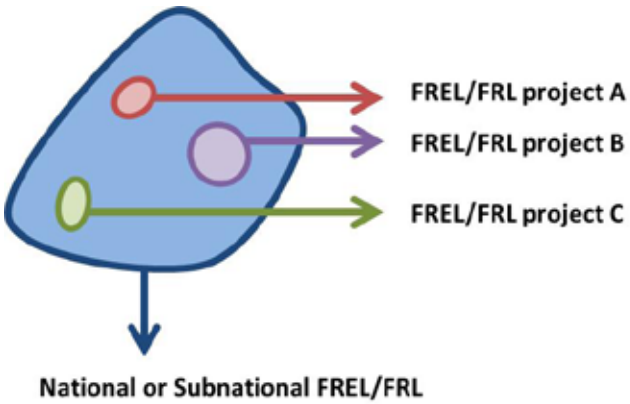


Figure 11. Graphical representation of a national or subnational FREL/FRL with in the national territory several projects spatially overlapping with the national or subnational FREL/FRL with their own Forest Reference Level against which results-based payments may be received

When designing a national or subnational FREL/FRL, countries may decide to recognize these different project-based FREL/FRLs. This may require countries to subtract the results achieved through these various project-based FREL/FRLs from the national or subnational results in order to avoid double counting of the same emission reductions (for instance, in the case carbon credits have been sold).

The results from these various project-level FREL/FRLs may be based on different methodologies and data sources. This could also raise issues of equity, whereby projects with less conservative FREL/FRLs could be rewarded unevenly with projects, or subnational or national programs, that use more conservative FREL/FRLs.

REDD+ countries may wish to engage with implementing actors of projects to discuss harmonization of FREL/FRL construction approaches (e.g. data, methodology, assumptions, adjustments, updating frequency, etc). This could be done by creating a set of guiding principles or requirements for the development of projects, or any smaller scale FREL/FRLs that aim at ensuring consistency with the national (or subnational) level. For instance, countries may wish to consider common requirements such as:

- Consistency with guidance from the UNFCCC (e.g. use of IPCC methods for estimating C stock changes and associated emissions and removals);
- Use of activity data consistent with national level data used for the GHG inventory and FREL/FRLs, for example, consistent use of:
  - Land classification systems (that can be aggregated up to the 6 IPCC land use classes) and consistent stratification by land use, forest type or other;
  - Remote sensing data to determine land-cover change.
- Use of nationally determined emission factors;
- Specifying eligible activities and pools;
- Use of a construction approach that is either consistent with, or results in a more conservative project-level FREL/FRL, than the FREL/FRLs set by the Government at a higher level (e.g. province or national) within which the project/program is nested;
- Provisions to manage displacement of emissions (e.g. discounting for measured leakage);
- Provisions to manage permanence of results (e.g. contribution to a buffer reserve).

Creating such national guidelines could increase consistency among project-level and national-level FREL/FRLs, reduce the risk of double-counting, and enable benefit-sharing systems that may be perceived as more equitable. The trade-off may be limiting innovation and private sector investment that is often more attractive at smaller scales and with higher levels of flexibility (i.e. not restricted by above guidelines).

Scale considerations

Although countries may initially submit a subnational FREL/FRL, the ultimate objective of REDD+ under the UNFCCC is a national FREL/FRL. Therefore, scaling up to the national level should be a consideration for all countries. The higher level of detail and complexity that can be measured in smaller subnational areas may have trade-offs with consistency, transparency and cost-effectiveness at the larger scale. Technical challenges associated with FREL/FRLs constructed for smaller land units may include higher transaction costs and may require efforts to detect if displacement of emissions (leakage) occurs. The initial scale may be set based on the significance of historical emissions in the subnational unit. Additional considerations may include the capacity to implement activities, the likelihood of successful implementation, the availability of data, the scale and nature of drivers and whether the local experiences can offer lessons learned for the national level. Brazil for example states in its FREL/FRL submission to the UNFCCC that it includes only the Amazon biome given its high level of forest related emissions and will subsequently include other biomes over time in order of highest the level of emissions.

Scale guiding questions

- ✓ What FREL/FRL approach would best suit your country, starting at national-level or subnational development?
- ✓ If starting with a subnational FREL/FRL, what are the relevant considerations for choosing the scale of the sub-national FREL/FRL(s)?
- ✓ Does the government want to recognize ongoing sub-national projects/programmes with operating FREL/FRL(s)?

  If so, how can consistency be enhanced among multiple operational FREL/FRLs within your country?

3.1.4 *Data selection and analysis*

Assessing historical emissions

FREL/FRLs should be expressed in tonnes of carbon dioxide equivalent per year[47]. Therefore, FREL/FRLs expressed in other metrics, for instance, by hectares of forest area loss, would not be acceptable under the UNFCCC.

There are two methods described by (IPCC, 2006)[48] to estimate changes in carbon stock.

- Stock-Difference method; estimation of difference in carbon stocks of a land unit by comparing carbon stocks for the same location at time 1 and 2. It generally requires comparing measurements from national forest inventory cycles.
- Gain-Loss method. This method is applicable at all IPCC Tiers and subtracts biomass carbon loss from biomass carbon gain.

Section 2.1 of the GFOI Methods and Guidance Document (GFOI, 2014) discusses gain-loss and stock-difference (or stock-change) methods as applied to REDD+ activities and has a decision tree on the choice between them.

An emission factor (EF)[49] is a coefficient that quantifies emissions per unit 'activity'. To estimate emissions and removals from forest land (IPCC, 2003, 2006), the EF should be multiplied by information on the extent of human activities (called 'activity data' – AD). This is illustrated in Figure 12. Detailed guidance on how to combine AD and EFs to make measurable, reportable and verifiable emission estimates is found in (GFOI, 2014). (IPCC 2003, 2006)[50] provides generic guidance on initiating and maintaining a data collection program, including how to evaluate existing sources of data, and planning new emission measurements, surveys and sampling, and (GFOI, 2014) complements this in the REDD+ context.

The most common approach applied so far by developing countries (discussed in FAO, 2014) to estimate historical emissions from deforestation for use in FREL/FRLs is to develop activity data through analysis of remote sensing (e.g. Landsat or higher resolution) images. Emission factors are estimated by calculating the difference of average carbon stock in forest biomass with the carbon stock in the replacing land use biomass (e.g. crop land). In this approach the average carbon stocks of both land uses are estimated based on NFI data (only from one cycle and not comparing two as with the stock-difference method), literature and/or IPCC default values.

In the selection of AD and EFs for FREL/FRL construction, consistency should be maintained with the data used for the national GHG inventory or vice versa. Coordination between groups working on FREL/FRLs and the GHG inventory could therefore be beneficial to ensure the FRL construction is in line with UNFCCC guidance.

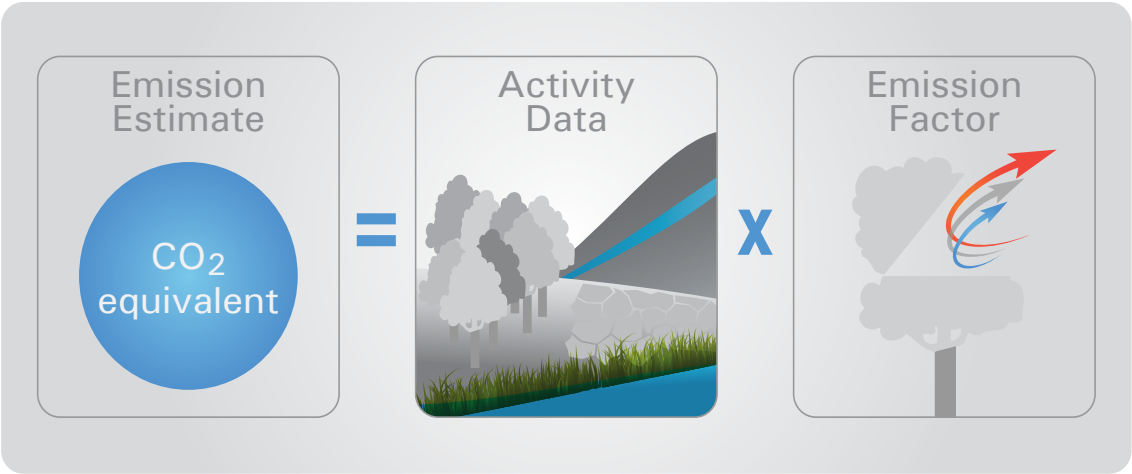


Figure 12. Simple methodological approach to estimate emissions from forest land proposed by IPCC

47 UNFCCC, Decision 12/CP.17
48 http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_02_Ch2_Generic.pdf
49 In case the extent of human activities results in enhancement of carbon stocks, the associated per hectare removals would be a removal factor rather than an emission factor. However, in the remainder of this document we only use the term emission factor to refer to per hectare emissions or removals.
50 http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/1_Volume1/V1_2_Ch2_DataCollection.pdf

Addressing data uncertainty

Historical emission data used in FREL/FRL construction should be consistent with the IPCC good practice principle of being neither over-nor under-estimated so far as can be judged and having uncertainties reduced so far as is practicable. However, in the context of result-based payments as discussed in section 3.1.2, a conservative estimate could be used if accurate estimates cannot be produced. Though there is no specific call for an uncertainty analysis as part of a FREL/FRL submission, estimation of uncertainties could be an important component to demonstrate information is transparent and accurate.

Reporting of uncertainties should facilitate the technical assessment. High uncertainty should not exclude countries from participating in REDD+ (as explained in section 3.1.2) but documentation for highly uncertain source categories is important for transparency in reporting. The larger the uncertainty is, the less certain it becomes that any differences in measured results reflect performance or random fluctuations. Therefore high uncertainties point out to areas for further improvements. Several existing REDD+ initiatives or funding instruments require information on uncertainties and, in some cases, a "discount" for them e.g. the Forest Carbon Partnership Facility (FCPF) Carbon Fund methodological framework[51] (FCPF, 2013) sets aside 0-15% of emission reductions in a buffer according to the uncertainty of the emission reduction estimates. IPCC suggests uncertainties may be reduced through stratification of data (more guidance on stratification can be found in GOFC-GOLD, 2013).

Countries may wish to adopt Quality Control and Quality Assurance procedures to increase transparency and minimize the likelihood of internal inconsistency in calculations. QA/QC is discussed by IPCC. The IPCC 2006 Guidelines for GHG Inventories provides guidance for Quality Assurance/Quality Control (QA/QC). QA/QC should be implemented to minimize errors and inconsistencies. Section 3.7 of the GFOI Methods and Guidance Document (GFOI, 2014) provides advice on the use of statistical methods to correct for bias in activity data, and to produce overall uncertainty estimates by combining activity data and emission factor uncertainties. UN-REDD will soon release a practical guidance document which enables a step-by-step accuracy assessment of forest land (change) maps with a specific focus on assessing the accuracy of the global tree cover product from (Hansen *et a*l, 2013).

Reference period and data points

The UNFCCC requires historical data to be taken into account for the construction of FREL/FRLs but does not prescribe the length, period or number of data points that countries should use in the analysis of historical data.

The length of the reference period may depend on the availability and quality of historical data. A relatively long time period would better capture historical emission patterns or trends. However, overstretching the reference period may result in the inclusion of emission patterns/trends that are not representative of expected future emissions, and therefore may not provide a good basis for the FREL/FRL construction, especially if emission patterns are changing rapidly in a given country. The length and period of the historical time series used in FREL/FRL construction should provide for a realistic and robust benchmark to assess the mitigation performance of REDD+ activities.

The same logic should apply when a country decides on the number of historical data points it should use (noting here that with historical data points we refer to change assessments). A FREL/FRL based on two forest land assessments over time will provide only one change assessment, but no information on whether the change (e.g. the deforestation rate) is changing over time in intensity. Ideally, the number of points should be sufficient to understand dynamics and possible trends in historical emissions. This would enhance a country's capacity to identify key national circumstances to be considered, and also choose the most appropriate FREL/FRL construction approach.

The number of past assessment points needed may depend on the FREL/FRL construction approach chosen; e.g. a trend extrapolation would necessarily require more than two historical data points. More points could be necessary to make a trend extrapolation more convincing. Table 2 provides an overview of the historical period used in the FREL/FRL creation of demonstration activities in different countries (More detail in FAO, 2014: Emerging approaches to Forest Reference Emission Levels and/or Forest Reference Levels for REDD+).

51 http://www.forestcarbonpartnership.org/sites/fcp/files/2014/MArch/March/FCPF%20Carbon%20Fund%20Methodological%20Framework%20Final%20Dec%2020%202013.pdf

Table 2. Examples of historical period and data points (change assessments) used for FREL/FRL construction in UNFCCC submissions to date (February 2015)

Country	Historical period used in FREL/ FRL construction	Change assessments (data points)	Construction approach
Brazil	1996-2005 (for 2006-2010 FREL) 1996-2010 (for 2011-2015 FREL)	7 (for 2006-2010 FREL) 12 (for 2011-2015 FREL)	Historical average using dynamic mean
Ecuador	2000-2008	1	Historical average
Colombia	2000-2012	6	Historical average plus 10% adjustment for national circumstances
Guyana	2001-2012	5 (for AD deforestation) 11 (for AD degradation)	Historical average (mid-way national and global historical average)
Malaysia	1990-2005 (for 2006-2010 FREL) 1990-2010 (for 2011-2015 FREL)	2 (for 2006-2010 FREL) 3 (for 2011-2015 FREL)	Historical average using dynamic mean
Mexico	2000-2010	3 (for deforestation) 10 (for fire)	Historical average

Activity data and representation of lands for FREL/FRLs

When developing FREL/FRLs, countries are expected to consider historical data. For activity data in the context of REDD+, this implies looking at historical data to assess change in forest land use over a given time period. Historical activity data are typically estimated through remote sensing or satellite land monitoring systems[52], but may also be estimated using other means such as land survey, land registry records, forest inventories, etc., especially for activity data related to forest degradation (i.e. for the gain-loss method, the activity data may consist of wood harvesting statistics which may not be adequately captured by remote sensing).

The IPCC provides three approaches to collect land activity data[53]:

- Approach 1: Data only represent net changes in land-use areas tracked over time and do not provide spatially explicit information, exact locations or patterns of land-use changes. Changes from one category to another are also not tracked.
- Approach 2: Information about net losses and gains in specific land-use categories including conversions from/to other categories are included in the data, but without spatially explicit location data.
- Approach 3: Provides spatially explicit observations of land-use categories and conversions, often tracking patterns at specific point locations and/or using gridded map products, such as derived from remote sensing imagery.

When reporting on activity data in their national GHG inventory, countries should use the IPCC land representation and conversion categories. Countries seeking access to results-based REDD+ payments under the UNFCCC also should, if possible, report on the land coverage and changes therein resulting from the implementation of their REDD+ activities. However, the IPCC reporting categories for land representation do not map one-to-one to the five REDD+ activities. Table 3 includes an attempt to map REDD+ activities to IPCC land (conversion) categories.

Deforestation implies a conversion from forest land to another land category. Four of the five REDD+ activities potentially fall into the forest land remaining forest land category. One way of assessing biomass changes in forest land remaining forest land would be by monitoring forest biomass through repeated NFI cycles (allowing for a stock-difference method, discussed at the beginning of section 3.1.4). However, developing countries rarely dispose over repeated NFI cycles, which is why they often rely on remote sensing data with which it is easier to detect changes in land use (forest to non-forest)

52 UNFCCC, Decision 4/CP.15 requests countries to use a combination of remote sensing and ground base forest carbon inventory approaches for estimating emission by sources and removals by sinks, forest carbon stocks and forest area changes.
53 The UNFCCC decision in Poznan (2008) on REDD+ states that national forest monitoring systems should take note of IPCC guidance on "consistent representation of land". The three approaches are proposed for land representation.

than it is to detect changes in biomass in forest remaining forest. Greater availability of higher resolution data, combined with stratification appropriate to national circumstances may help. Examples of attempts to also address degradation are seen in demonstration activities in Nepal and Vietnam among others (FAO, 2014). Both are testing the use of high resolution imagery to create matrices based on IPCC land categories, which are subsequently subdivided based on average carbon content estimates obtained from ground measurements. Box 4 illustrates how Mexico used a land transition matrix in its UNFCCC submission capturing the IPCC land categories, their changes and the associated REDD+ activities.

Table 3. Comparison of IPCC categories to REDD+ Activities

IPCC land (conversion) category	Eligible REDD+ Activities (per Cancun Agreements)
Forest land converted to other land uses	Reducing emissions from deforestation
Forest land remaining as forest land	Reducing emissions from forest degradation Conservation of forest carbon stocks Sustainable management of forests Enhancement of forest carbon stocks
Other land uses converted to forest land	Enhancement of forest carbon stocks

Emission factors for FREL/FRLs

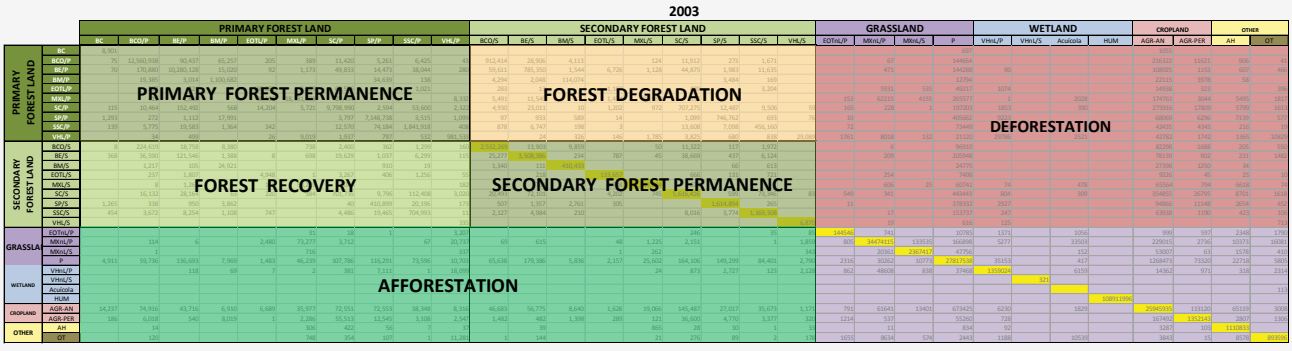
The IPCC provides three tiers for the development of GHGs emissions and removals. Tiers represent an increasing level of expected accuracy of emission factors. The choice of which tier to use will depend on a country's data availability and capacity.

- Tier 1: Use of default emission factors provided through the Emission Factor Database[54], or alternatively in the IPCC Guidelines; the IPCC suggest this method "should be feasible for all countries".
- Tier 2: Use of country specific emission factors or non-default more specific factors . This may include emission factors from the Emission Factor Database if they are specific for the country.

Box 4. Mexico's use of a land transition matrix

In its FREL submission to the UNFCCC (Dec 2014), Mexico uses a land transition matrix to report area change for various land categories and associated emissions from REDD+ activities (Table 4) . Using a land transition matrix may help to increase consistency between IPCC land category reporting in the GHG inventory and REDD+ activity based results reporting (in the technical annex to the BUR) by transparently showing how they relate.

Table 4. Matrix in Mexico's FREL submission where IPCC category conversions are labelled with the associated REDD+ activities.



In a land transition matrix, the rows represent the land category in the initial time point, and the columns represent the land category in the latest time point. So it should be read as a conversion from the land category in the row to the land category in the column where the diagonal cells in the matrix represents no change in land-use category between the two years. Countries may choose the level of detail of different land-use categories according to national circumstances and available data. For forest land, a country may choose to cluster all forest types into one single category, or may want to break it down into various forest types or forest structure classes (subcategories). To do so, a country may rely upon its own national forest/land classification system or use other available classification systems[a].

a The Land Cover Classification System may be useful: http://www.glcn.org/sof_1_en.jsp

54 http://www.ipcc-nggip.iges.or.jp/EFDB/main.php

- Tier 3: Higher order methods are used including models and inventory measurement systems tailored to address national circumstances, repeated over time, and driven by high-resolution activity data and disaggregated at sub-national to fine-grid scales. Properly implemented, Tier 2 and 3 methods are expected to provide estimates of greater certainty than lower tiers.

Typically, emission factors are obtained from (country- or region-specific) literature or ground measurements in forest plots e.g. from (national) forest inventories which are subsequently converted into carbon stock estimates per hectare using allometric equations[55], biomass expansion factors, wood density data, and conversion factors. When per hectare emission estimates are made using the gain-loss method, data may be obtained from sampling, timber extraction records, growth tables, household surveys on (fuel) wood extraction, and/or post-disturbance regrowth estimates.

Countries may choose a stepwise approach through which they initially use default factors to construct their first FREL/FRL while collecting better country specific data over time to replace these. Countries may also use default factors for certain pools and country-specific data for others. Constructing a FREL/FRL before more specific emission factor data is available may provide more focus on what specific emission factor data needs to be collected and what level of complexity is desired in the emission factor estimation.

If a country wishes to use multiple emission factors some considerations for stratification may be examined. In order to combine activity data with associated emission factors, it may be practical to stratify data into groups of more or less homogenous carbon contents, keeping in mind the activity data has to be available for the proposed stratification. (FAO, 2014) provides an overview of initial EF stratifications chosen by countries including stratifications by forest type, structure (primary, secondary), and management type (e.g. planted and natural forest). Consistency with stratification of EFs in the GHG inventory should be pursued.

Multiple EFs will differentiate emission estimates from different types of forests putting more weight on the loss of high carbon content forest. Therefore, the number of EFs included in a FREL/FRL may depend on various criteria, including the availability of data, the planned REDD+ activities and the forest definition.

Considerations for data selection and analysis

Countries may start by evaluating what historical data they have available to provide estimates for activity data and emission factors and assess the quality of this data which may be particularly relevant for their choice of approach to FREL/FRL construction. They may also assess whether the historical period and the number of change assessments (data points) are sufficient. Based on the availability of data and their priorities the country can decide the best stepwise approach to follow for their FREL/FRL, as well as identify gaps and priorities for further data collection.

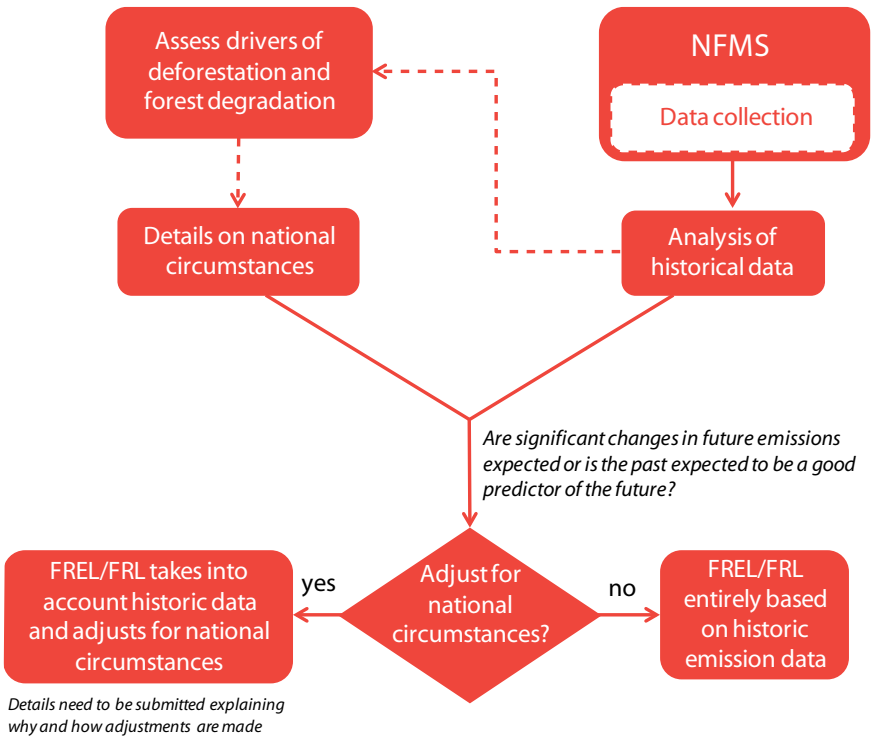
Data analysis guiding questions

- ✓ What activity data is available in your country and is there a need to collect additional activity data?
- ✓ Which REDD+ activities does the available activity data capture?
- ✓ How many data points are available and are they sufficient for the proposed FREL/FRL construction approach (see next section)?
- ✓ What period is covered by the activity data? Is it sufficient and can the period be considered representative of future emissions in the FREL/FRL period?
- ✓ What emission factor data is available?
- ✓ Is there a need to develop more (country-specific) EFs and, if so, would your country start with what is available and plan for collection of more EF information later?
- ✓ What stratification would be most meaningful to your national circumstances and what will be the need in terms of EFs for such stratification in estimating historical emissions?
- ✓ Are AD available per stratum in the proposed EF stratification (e.g. if the stratification is per forest type, is forest loss data available per forest type)?

55 The international web platform GlobAllomeTree for tree allometric equations to support volume, biomass and carbon stock assessment may be useful: http://www.globallometree.org.

3.1.5 *FREL/FRL construction approach and national circumstances*

FREL/FRLs are considered a "benchmark to assess a country's performance in implementing REDD+ activities" in the context of the UNFCCC. In this regard, the FREL/FRL would represent what would happen in the absence of REDD+ activities. An understanding of forest land-use dynamics may be helpful. Thus, the choice of a FREL/FRL construction approach can be taken based on available data, the results derived from analyzing historical forest land-use dynamics, and a country's analysis of its national circumstances. In the process, countries should remember that they can improve their methodology over time through a stepwise approach[56]. Figure 13 provides a possible work flow for selecting an approach to FREL/FRL.



A historical analysis of past forest land-use change may improve the understanding of the drivers of deforestation and forest degradation. Details of national circumstances provide information on a country's specific context which may explain pressures on forest resources, including expected future pressures.

When undertaking historical analyses of emissions from the forest sector, countries should assess whether a clear tendency or trend in emissions can be seen. If there is no clear trend (e.g. upward or downward trend) and if national circumstances are not expected to change significantly from those of the past, a historical average of past emissions could be considered a good approach for setting a benchmark.

Figure 13. Work flow for selecting an approach for FREL/FRL construction; dotted arrows represent connections which may not apply to all countries.

In situations when the analysis of historical data shows a clear upwards or downwards trend in historical emissions, or when future national circumstances may differ significantly from those of the past (e.g. due to anticipated increased pressure on forests) a historical average may be a poor predictor of the future. In such cases, FREL/FRLs could be adjusted for national circumstances. Box 5 sets out three different situations countries wanting to participate in REDD+ could find themselves in.

National circumstances and the concept of adjustment

When developing their FREL/FRLs, countries should prepare to submit details of their national circumstances. Such information, if appropriate, could be used by a country to adjust its FREL/FRLs upwards or downwards, deviating from historical data (average or trend), to take into account various elements specific to a country's context. Countries have proposed adjustments to FREL/FRLs (in UNFCCC submissions and through demonstration activities, as illustrated in FAO, 2014) based on the following types of information on national circumstances:

- Population: growth rates, distribution, migration, density and other vital statistics including associated issues on food security
- Economy, including agriculture, mining, industry and other sectors
- Conflicts and post-conflict situations
- Foreseen land development plans and policies

56 UNFCCC, Decision 12/CP.17, par. 10

Box 5. The use of historical average emissions for constructing FREL/ FRLs

Country A faces a linear, steady forest area loss, corresponding to an equal annual forest area loss. This also corresponds to an equal amount of annual emissions from deforestation.

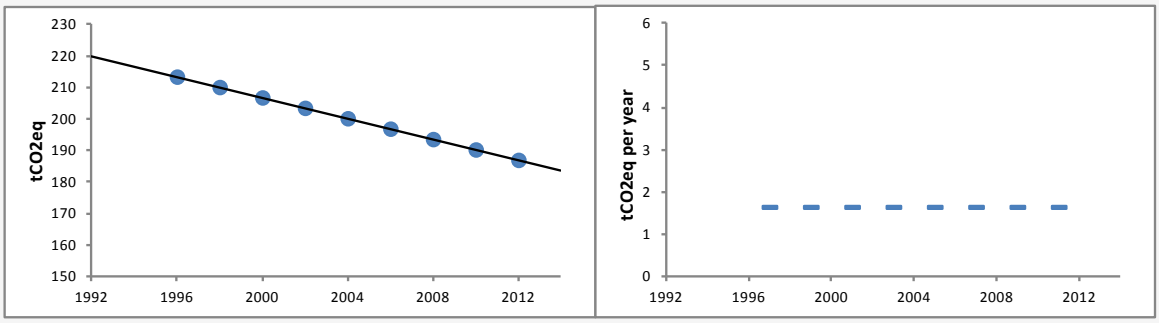
Country B is experiencing accelerating forest area loss, which is increasing year after year. For Country B, using a historical average to construct a FREL/FRL would probably underestimate future emissions and may not be the most appropriate method. In this case, Country B may consider a more representative method, such as a linear trend projection or by adjusting its FREL/FRL (see following section).

Country C is faced with a declining deforestation rate and its forest area is stabilizing. In this context, using a historical average may well overestimate future emissions.

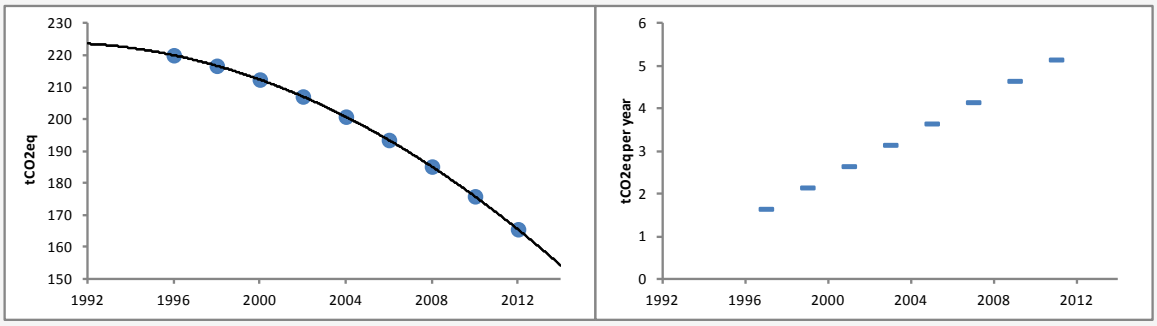
Total forest carbon stock:

Associated emissions:
(from deforestation)

COUNTRY A



COUNTRY B



COUNTRY C

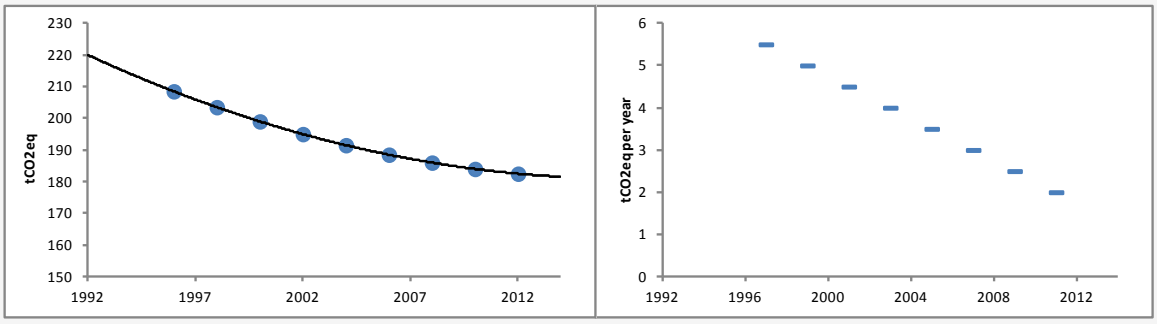


Figure 14. Examples of forest carbon stock trends and associated emission patterns

Country A, B and C illustrate hypothetical, predictable emission patterns. However, the forest emissions in reality could be more complex. The next section discusses how countries could approximate these different trends.

Box 6. FREL/FRL establishment and the forest transition curve

The forest transition curve (Fig 14) visualizes a theory of how forest area changes over time in a country (Mather, 1992). The theory suggests a broadly predictable pattern of forest cover change driven by socio-economic, society-wide transformations towards increased industrialization and urbanization. In the first phase, a country has a high and relatively stable portion of land under forest with low-moderate deforestation rates. Next, deforestation begins and accelerates with increased investments and commercial agriculture, reaching high levels, after which it slows down again as jobs in industry draws people out of the rural sector.

If the forest transition theory were applicable to all countries, using a FREL/FRL construction approach solely based on historical average would provide limited incentives to high forest cover, low deforestation (or pre-transition) countries from participating in REDD+ implementation. On the other hand, it would provide more generous incentives to countries with the highest (future) emission reduction potential, such as those located in the "early transition" and "late transition" categories.

However, the theory may not apply to all countries and it can be difficult for countries to position themselves on the curve. The transition phases may reflect longer time periods than reflected in FREL/FRLs making it difficult to see a practical application of the transition curve theory in FREL/FRL construction.

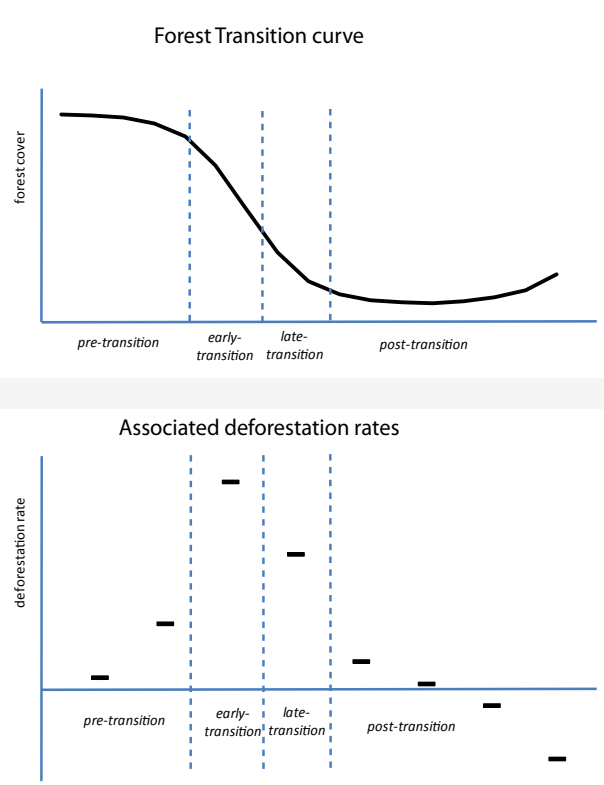


Figure 15. Forest transition curve and associated deforestation rates

Countries situated at the early stage of the forest transition curve (see Box 6), i.e. those with a high forest area and low deforestation rate (HFLDs), may feel it is appropriate to adjust their FREL/FRLs for national circumstances if the past is deemed a poor predictor of the future, notably if they anticipate increasing pressures on their forests.

Possible adjustment calculation approaches

Adjustments to FREL/FRLs may be calculated in several ways provided that the calculations result in transparent, complete (meaning that information provided allows for its reconstruction), consistent and accurate estimates[57].

A simple approach to calculate the adjustment is to estimate future forest emissions that may arise from national or land development plans, for instance, estimated emissions from planned road, mining, timber harvesting, and infrastructure or settlements. The latter has been proposed by the Republic of Congo and Peru in sub-national REDD+ demonstration activities (see FAO, 2014).

57 Paragraph (b) of the annex to Decision 12/CP.7

Other countries propose an adjustment based on other considerations. For example, Guyana proposes an adjustment based on the average global deforestation rate (where the Forest Reference Level is mid-way the historical deforestation rate in the country and the global average deforestation rate). Colombia proposes an adjustment which is a percentage of the historical deforestation rate (+10%) and which adjusts for a conflict situation during the historical period (post-conflict adjustment).

Another possibility would be to use a more complex modeling approach[58] to assess future land use changes and/or forest carbon stock and emissions change to calculate the adjustment. Many different models and modeling platforms exist, which may be used for different purposes. Models may be used to improve historical or actual emission estimates (e.g. for Tier 3) or models may be predictive, simulating a changing system behavior and changing trends in emissions in the future (e.g. to adjust for national circumstances). Table 5 provides examples of different types of models and model platforms and in which way they may affect FREL/FRL calculations. Many models or modeling platforms listed in Table 5 may not necessarily be useful to adjust for national circumstances.

Table 5. Examples of different types of models and how they may influence FREL/FRL calculations

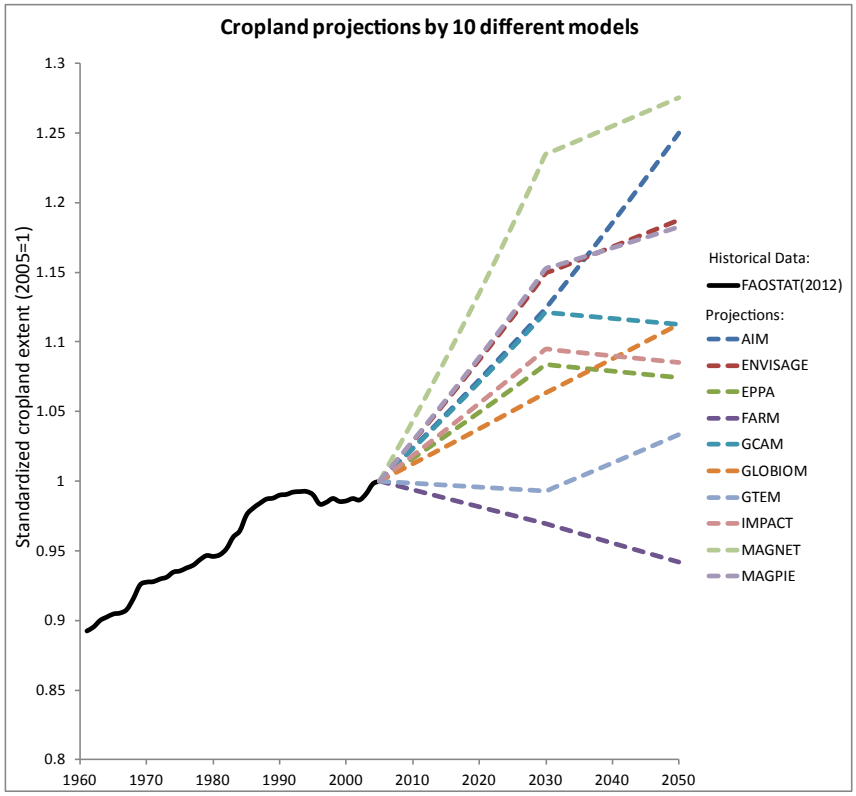
Type of model	How it may influence FREL/FRL calculation	Typical input parameters	Model platform examples		
Wood and/or carbon stock dynamics model - *typically connected to below model as timber/fuelwood supply*	May project emission factors (EF are simulated by the model as a result of dynamic flows between carbon pools)	Volume growing curves, age distribution, harvested volume - *Typically from wood demand model, can have optional inputs on landuse change information*	EFISCEN, CBM-CFS3	G4M	Integrated assessment models (IAM): GLOBIOM, IMAGE
Economic wood demand model - *typically connected to above model as timber/fuelwood harvesting*	May project activity data (degradation) *e.g. through wood extraction from above wood/carbon stock models*	External GDP projection, trade assumptions, price projections	EFI-GTM		
Spatial location models	May project EF estimation *e.g. by predicting future forest loss location and associated forest type/ structure)*	Maps of (locations of) historical forest loss and maps of variables of predictive value (*e.g. distance to roads, settlements, etc.*)	Dinamica-EGO, Land Change Modeler, CLUE(-S) – *some of these modeling platforms include options to project forest loss quantity as well*		
Economic models simulating land-use change	May project activity data (deforestation), may be used to adjust for national circumstances	GDP projection, population projection, demand for agricultural land, opportunity cost calculations, policy assumptions, etc.	General and Partial Equilibrium Models (economic models), logistic regression		

Models which simulate increased pressure on forests could typically be economic models simulating land-use change (which may include assumptions on future socio-economic and policy developments). Figure 16 illustrates that these models may produce very different results depending on the assumptions and platforms used. When variance in model results is high, confidence in one single projection is low. Some modelling approaches may require more bio-physical and/or socio-economic data than available for the country, increasing the number of assumptions to be made.

Concerning the UNFCCC requirements for FREL/FRL submissions (UNFCCC, 2012)[59], for complex models it may be particularly challenging to provide transparent and complete information. Models are often not as transparent as other

58 A model can be as simple as AD x EF. In this section, when we refer to models we refer to more complex models to assess future land use and forest carbon stock and emission changes with multiple assumptions and multiple data inputs.
59 Paragraph (b) of the annex to Decision 12/CP.7

simpler methods and the platforms may have such a high level of complexity that reconstruction of the FREL/FRL with the information provided may be very difficult. . A model used for predictive purposes must demonstrate to reproduce current estimates reasonably well. If, notwithstanding these challenges, a country desires to use a model to adjust for national circumstances, general principles on how to ensure consistency and transparency can be found in IPCC 2013 (for Annex I Forest Management Reference Levels) and guidance on how to document a complex model in a transparent way can be found in (IPCC, 2010).



Finally, models may be used in a more limited way, such as providing additional justification to a simpler and more transparent adjustment calculation, rather than being the basis of the FREL/FRL calculation. Furthermore they can be useful tools in supporting policy making and could for example be used in the National Strategy design, to explore the impacts of different policy options and to help select activities to include in the National Strategy or Action Plan as a domestic exercise.

Figure 16. Illustration of the high variance in global cropland projections up to 2050 by 10 different socio-economic land-use change models: all use the same historical data for cropland and all use the same exogenous assumptions on future GDP and population (source: Schmitz *et al*, 2014).

Selection of FREL/FRL construction approach

There are several options available to countries for the construction of FREL/FRLs. In general terms, these may involve the use of the historical average emissions, historical emission trend projections, adjustments based on policies and plans, or modeling approaches (e.g. considering population growth, timber harvest expectations, etc.). A brief summary of the main construction approach, along with some of their advantages and risks, is provided below in Table 6.

The choice of a construction approach should be based on an evaluation of the available data and its quality, as well as national circumstances. A historical average may be relatively simple to develop, which may explain why many REDD+ countries are opting to use it for their initial FREL/FRLs (see FAO, 2014). For example, Brazil—the first country to submit a FREL to the UNFCCC—has used a relatively simple (dynamic) historical average both for its submission to the UNFCCC, and (although on a different basis) for the first 5 years of its demonstration activity with the Amazon Fund. An analysis of historical data and a consideration of the national circumstances of a country should clarify whether the historical average is appropriate as a benchmark for assessing REDD+ performance and for yielding REDD+ incentivizes.

The UNFCCC does not prescribe what methodology countries should apply to establish FREL/FRLs and will not make judgments on a country's choice of methodology. The technical assessment will assess the information, including methodological information, submitted and assess whether it is transparent, complete (i.e. allowing for the reconstruction of the FREL/FRL), consistent and accurate and whether it includes future changes in relevant policies and measures. Countries may also make their choice of approach based on their participation in early REDD+ financing initiatives and demonstration activities (e.g. the FCPF Carbon Fund) that may include more specific guidance on the FREL/FRL construction.

Table 6. Some methodological options for construction of a FREL/FRL with their potential advantages and risks

Construction approach	Advantage	Risks
Historical average	Simple, transparent	May over or under-estimate future emissions
Linear projection	Easy to implement, transparent	May over or under-estimate future emissions (deforestation trends are often non-linear)
Non-linear projection	May be a better predictor of future emissions if historical data shows a non-linear trend.	May over or under-estimate future emissions. Non-linear projections can change very rapidly and are difficult to predict.
Modeling approach	Can capture future impact of drivers not reflected in historical data; can also include indirect drivers if relevant (e.g. population growth)	May be considered less transparent and may require subjective assumptions.
Inclusion of relevant policies and plans	Allow the incorporation of expected emissions not reflected in historical data, e.g. changing trends in timber, mining or agricultural concessions.	Expected emissions are difficult to estimate; assumptions about future changes to domestic policies may require strong justification to be credible.
Other adjustments (e.g. global/ regional rates or % adjustment)	Transparent, potentially easy to implement	May over or under-estimate future emissions. Assumes the rate to capture the dynamics or main drivers.

Construction approach and national circumstances guiding questions

- ✓ Is the past considered a good predictor of the future for the REDD+ activities included in the FREL/FRL in your country?
- ✓ Would you propose an adjustment of historical data to account for national circumstances? How are the national circumstances expected to be different from the past?
- ✓ Is there adequate data to make a transparent, credible and accurate adjustment for national circumstances? Are there policies and plans in place today that are expected to impact forest-related emissions/removals?
- ✓ If models are proposed for the FREL/FRL construction:
  - Does the model reproduce historical data (GHGI)?
  - Which verification activity has been performed?
  - Can the model be considered sufficiently transparent?
  - Can the model be considered sufficiently complete (meaning its description will allow for the reconstruction of the FREL/FRL)?
  - Is there enough data in the country to feed the model? Are assumptions to be made well supported by available information?
  - Is there enough expertise in the country to regularly update the model?

3.2 Combining the elements to construct a FREL/FRL

Figure 17 provides a simplified possible flow for FREL/FRL construction, combining the various elements discussed in this document. Data used to construct FREL/FRLs should be consistent with the data which will be used to estimate emissions and removals resulting from REDD+ activities in the country (e.g. later to be provided in the technical annex to the BUR). As such, the forest definition used for the FREL/FRL should be the same used for estimations reported in the GHG inventory. Data selection may depend on the availability of activity data and emission factors, forest definition and choice of scope.

Choices for scope should be driven by an assessment of significant activities, pools and gases but may be influenced by the availability and quality of data from the NFMS and other relevant sources. Additionally, choices for scope may be guided by what activities a country proposes in its National Strategy or Action Plan. A country may decide to take a stepwise approach, starting with a narrow scope (e.g. deforestation, above and below ground biomass only) with the intention of adding other activities, pools and gases over time.

A country may also decide to start at the subnational level. The National Strategy or Action Plan could inform the choice of the initial scale of implementation for REDD+. As discussed in Section 3.1.3, other elements may come into considerations when approaching scale, including data availability as well as implementation and monitoring capacity.

The analysis of historical data and national circumstances may provide the country with a better understanding of drivers of deforestation and forest degradation, information which not only informs Forest Reference Level construction but may also inform the process of the National Strategy or Action Plan.

Before selecting an approach to FREL/FRL construction, a country may want to analyze its data and try to understand the dynamics of anthropogenic forest-related emissions and removals. This understanding can be obtained from an analysis of historical data available, including from the NFMS. An analysis of national circumstances may provide a country with an enhanced understanding of how drivers may affect future trends of forest-related emissions and removals, which in return can support decision-making on potential adjustments. Altogether, these analyses can help countries take informed decisions on approaches for the construction of FREL/FRLs and provide a robust basis for an eventual submission to the UNFCCC.

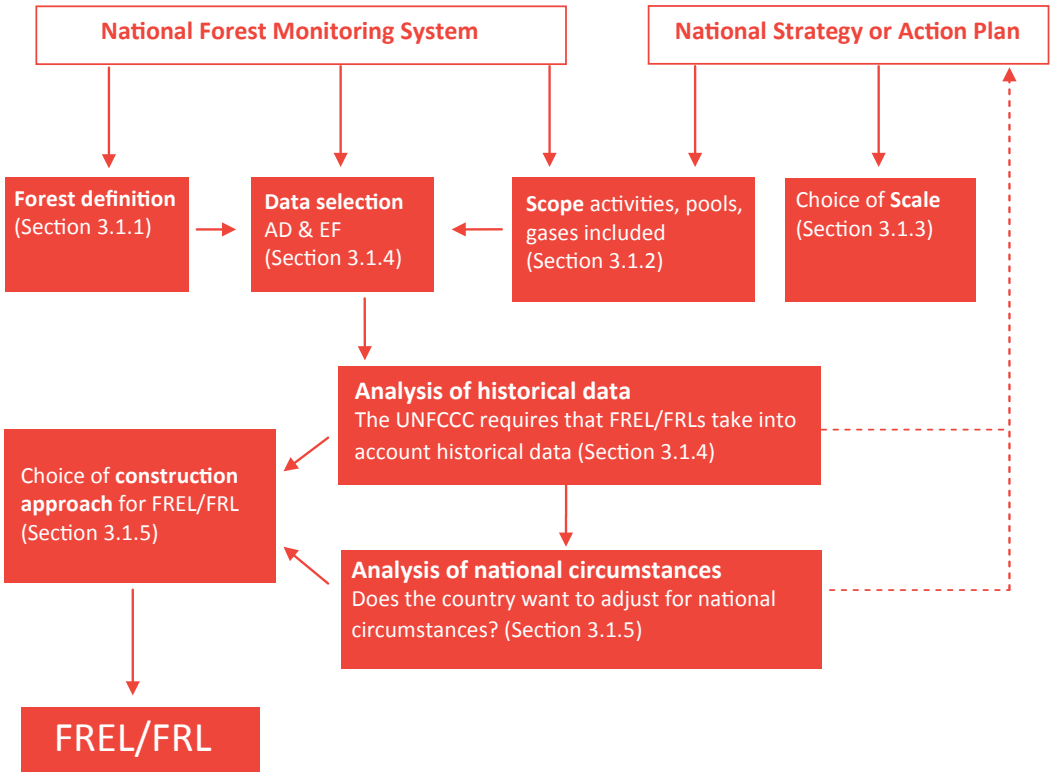


Figure 17. Simplified flow for FREL/FRL construction (showing the most logical connections only; the dotted arrow shows an optional linkage)

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