Synthesis Report: WWF-FCPF Technical Workshop on REDD+ Reference Levels

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FOREST CARBON PARTNERSHIP FACILITY

WORKSHOP REPORT

Contents

Preface

On January 28 and 29, 2013, the World Wildlife Fund (WWF) and the Forest Carbon Partnership Facility (FCPF) hosted a technical workshop called "Building REDD+ Reference Levels" at WWF's U.S. headquarters in Washington, D.C. The objective of the workshop was to provide an informal opportunity for representatives from several REDD+ countries to share their experiences in the development of national and subnational forest reference levels and to learn from their collective knowledge at a time when guidance on reference levels is being developed at the FCPF Carbon Fund and elsewhere. Workshop participants included a range of stakeholders from national and state governments, civil society organizations, REDD+ multilateral funds, the private sector, and academia (see Annex I for a full list of participants).

During the workshop, participants were invited to highlight major challenges and barriers that they faced in developing their forest reference levels, as well as to share lessons learned and outline technical capacity gaps in their countries (see Annex II for a detailed agenda of the workshop). This report summarizes the discussions and key findings of this workshop and highlights some possible pathways forward in light of these findings.

Acknowledgments

The hosts are grateful to all those who attended the workshop for their participation. In addition, we would like to thank Denise Boatwright for her coordination of the workshop logistics and the Facility Management Team (FMT) of the FCPF, in particular Ken Andrasko, Alex Lotsch and Rajesh Koirala.

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Disclaimer

This document is a report of the discussion that took place during the reference level technical workshop on January 28 and 29, 2013, in Washington, D.C. and does not necessarily represent the views of the workshop hosts or the countries that were represented. It reports on the broad variety of experience and views shared during presentations and in discussions among workshop participants. Additional background research was carried out by the authors of this report to provide a coherent synthesis of the workshop. The workshop took place under the Chatham House Rule (for further information, see http://www.chathamhouse.org/about-us/chathamhouserule-translations).

For more information on this workshop and to view the presentations, visit http://wwf.panda.org/what_we_do/footprint/forest_climate2/events/.

Introduction

What are reference levels?

The term *reference level,* despite the central role it plays within REDD+, is still ambiguously defined in the literature and in climate negotiations (Angelsen et al., 2011). Under the United Nations Framework Convention on Climate Change (UNFCCC), the terms forest reference emission level (FREL) and forest reference level (FRL) are often used in parallel, reflecting an unresolved distinction in the negotiations. While these terms have differences in their implications (many interpret FRL to refer to net uptake of CO2e and FREL to refer to gross emissions only), they are both used in the context of REDD+ to describe a benchmark of emissions over a given period in time and for a given geographical area against which future emissions will be measured. Throughout this report we use the notation *FRL* to indicate both forest reference levels and forest reference emission levels.

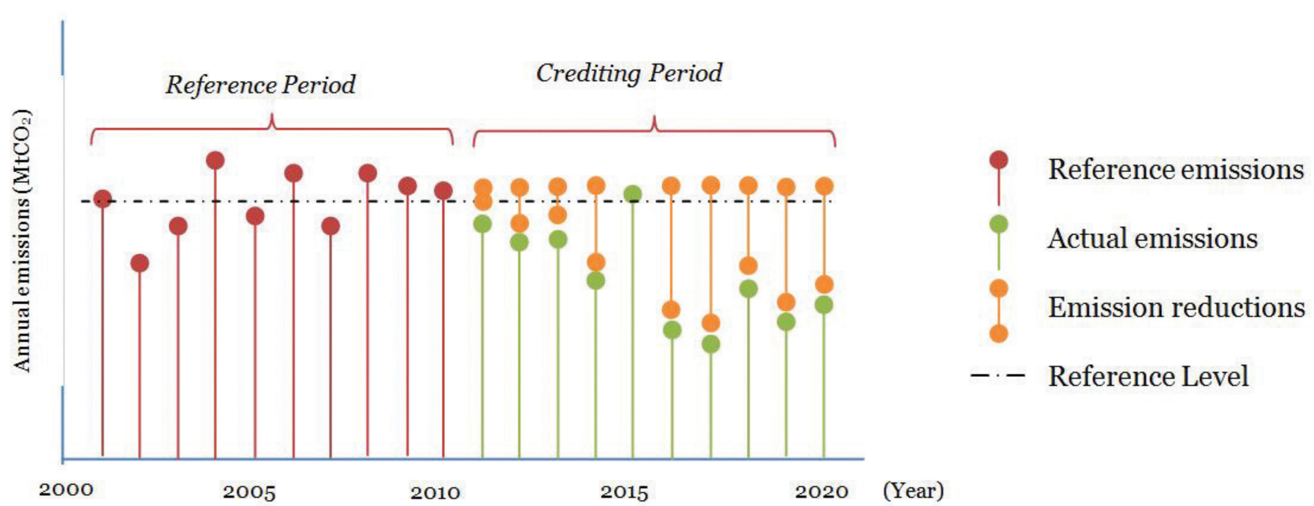
In this report, we define FRLs as the estimated quantity of greenhouse gas (GHG) emissions that would have occurred in the absence of REDD+ interventions. Emission reductions can be calculated as the difference between the FRL and the actual emissions occurring during the REDD+ intervention. Figure 1, below, shows a schematic of a sample FRL using a reference period of 2000–2010 and a crediting period of 2011–2020. The *reference period* is the time frame over which data are collected to construct the FRL, and the *crediting period* is the time frame of the REDD+ intervention. In the example below, a historical average has been used to calculate the FRL (with no adjustment), but as we discuss later, in Topic 5: Adjustments, there are other ways to calculate FRLs.

Why are reference levels important?

FRLs are a central component of REDD+ as they serve at least two overarching functions critical to the implementation of successful REDD+ national or subnational strategies.

- **Climate integrity:** FRLs are the benchmark against which performance in a country (or jurisdiction) is measured.[1] FRLs are therefore important in ensuring the overall contribution of REDD+ activities to a climate solution (e.g., demonstrating that emission reductions are additional and not double-counted).
- **Access to finance:** One of the fundamental pillars of REDD+ is that measurable reductions in emissions from deforestation and forest degradation should be tied with results-based payments.[2] FRLs are therefore an important yardstick for the scale of finance that a country may receive to implement REDD+. It has also been argued that by helping to demonstrate REDD+ results, robust FRLs are likely to attract additional finance to support REDD+ activities.

Figure 1 | Simplified schematic to show the relationship between an FRL and subsequent emission reductions



[1] *Decision 12/CP.17.*
[2] *Decision 2/CP.17 para 64.*

Workshop participants pointed out that FRLs can be important for several other reasons related to **climate integrity** and **access to finance.** For example, countries like Indonesia are exploring setting a national target for emission reductions and then allocating it to provinces, which may then have a top-down FRL set. Most countries and provinces will need to address this question of allocation in some way. Similarly, at the local scale, many countries or provinces are exploring how an FRL might help to allocate REDD+ monetary or nonmonetary benefits to the actors who address drivers of deforestation or degradation. FRL development can also be valuable in identifying areas where intervention strategies need to occur.

While these two functions should ideally be maximized when developing FRLs, they are not always well aligned, and in some situations may effectively be in competition. This can be demonstrated through two simple examples. First, setting an FRL *"too high"* (i.e., above business-as-usual levels) would lead to emission reductions being generated that are not additional to previous efforts, undermining the climate integrity of the FRL. At the same time, though, a higher FRL could allow a country or state to access more finance to implement REDD+, since the gap between actual emissions and predicted emissions would be larger. Conversely, setting FRLs *"too low"* would build a level of climate precaution into FRL design; this would penalize a country, though, by not fully rewarding its efforts in reducing emissions. This could prevent some countries that would otherwise be able to participate in a REDD+ mechanism from doing so, which could also negatively impact climate integrity. As we will discuss under the Conclusions section, these two ends of a spectrum are not always easy to align and need to be carefully balanced when designing and implementing FRLs in REDD+ countries.

In addition to this challenge, a country's financing needs are not always the same as the marketable value of its achievable emission reductions. In this regard there may be a tension between the scale of finance that might be generated through an FRL and the scale of finance necessary to implement a national REDD+ strategy. In this regard, it is often noted that performance-based payments under REDD+ make up only one of several existing and potential finance streams and should be used when possible to leverage finance from these other streams.

These complexities, in part, provide some of the context for the "Building REDD+ Reference Levels" technical workshop. Countries have had very different experiences in the development of their national and subnational FRLs and have widely varying contexts in which they develop them. The workshop was a platform for participants from countries in a diversity of circumstances to share their experiences and to learn lessons from other countries designing FRLs.

What has been agreed upon so far?

FRLs are being negotiated under several key international policy arenas, most notably the United Nations Framework Convention on Climate Change (UNFCCC) and the Forest Carbon Partnership Facility (FCPF). The UNFCCC has been negotiating FRL design for approximately five years under the Subsidiary Body for Scientific and Technical Advice (SBSTA). Over this period, Parties and observers have submitted a wide range of views, participated in multiple workshops, and generated various decisions and texts. The FCPF is now developing a methodological framework under the Carbon Fund, which is expected to be completed by late 2013 (see FCPF section below).

The voluntary carbon markets have also provided a signaling body for the development of FRLs. The Verified Carbon Standard (VCS) has developed the Jurisdictional and Nested REDD (JNR) methodology as well as several other REDD-specific methodologies under the Agriculture, Forestry and Other Land Use (AFOLU) working group.[3] Other voluntary certification schemes (e.g., American Carbon Registry, CarbonFix, Gold Standard) have provided guidance on REDD+ FRLs. Finally, some countries have already defined FRLs as part of bilateral REDD+ funding agreements, for example, as part of the Guyana-Norway and Brazil-Norway REDD+ agreements.[4]

The following sections will summarize the major decisions on FRLs that have been achieved under the UNFCCC.

[3] *More information on JNR and AFOLU can be found at http://v-c-s.org/sites/v-c-s.org/files/FactSheet%20JNRI%202012%20-%20MidRes.pdf and http://v-c-s.org/node/286, respectively.*

[4] *The RL that Guyana or Brazil ultimately submits to the UNFCCC might not be the same as those used under their bilateral arrangements with Norway.*

COP 13: Bali, 2007

In Bali, Parties agreed on a framework for developing the methodological elements of REDD+ in an annex to the decision on REDD+.[5] This Annex states, *"Subnational approaches, where applied, should constitute a step towards the development of national approaches, reference levels and estimates."*

COP 15: Copenhagen, 2009

The first substantive Decision on FRLs came in Copenhagen, where it was agreed *"developing country Parties in establishing [FRLs] should do so transparently taking into account historic data, and adjust for national circumstances, in accordance with relevant decisions of the Conference of the Parties."*[6] This decision sent an important signal to Parties that FRLs could be adjusted and might not be a purely historical average or trend of emissions over a given period.

COP 16: Cancun, 2010

At COP 16, in Cancun, developing country Parties wishing to engage in REDD+ were requested to develop a *"national [FRL] or, if appropriate, as an interim measure, subnational [FRLs]."*[7] It was further stipulated that national FRLs could be a combination of subnational FRLs. This invitation was the first of its kind under the UNFCCC and provided a signal to developing countries that they should begin the development of their REDD+ FRLs.

COP 17: Durban, 2011

At COP 17 in Durban, Parties reached a landmark decision on FRLs.[8] This decision provided the following key guidance for countries submitting REDD+ FRLs:

- FRLs should be expressed in tonnes CO_2 equivalent/year.
- FRLs are the benchmarks for assessing a country's performance in implementing REDD+.
- Countries were invited to submit their proposed FRLs and accompanying information and rationale when they are ready and on a voluntary basis.
- FRLs are developed and submitted in an iterative process (they would not necessarily be a one-time submission), and subnational FRLs could be used as an interim step toward national FRLs.
- Detailed guidance was provided in an Annex for how countries should develop FRLs, including:
  - Information should be transparent, complete, consistent and accurate;
  - This information should include data sets, methods, models, assumptions, descriptions of changes from other submitted information, pools, gases, activities, etc.; and
  - Forest definitions, if inconsistent with those used in UNFCCC national inventories or submissions to other international organizations should be accompanied by an explanation as to why.

At COP 17, Parties also established a process for *assessing* FRLs. The delineation of the assessment process is still ongoing.

COP 18: Doha, 2012

While some progress was made on FRLs at Doha, including a draft decision text that highlights the linkages between FRLs, forest monitoring systems, and measurement reporting and verification (MRV), ultimately an agreement was delayed, in part due to political differences in the interpretation of "verification."[9]

SBSTA 38, Bonn, 2013

SBSTA 38 made significant progress toward resolving some of the verification issues from Doha and establishing a UNFCCC FRL assessment process for proposed FRLs. The draft decision continues to integrate FRLs into other methodological issues of REDD (MRV, NFMS) and begins to identify the core elements of how proposed and submitted FRLs will be assessed by the UNFCCC. To date, no country has submitted a proposed subnational or national FRL to the UNFCCC. Many countries are working on FRLs, and the UNFCCC secretariat indicated that they are ready to receive and post proposed FRLs to the UNFCCC REDD Web

[5] *The Annex is at the end of Decision 2/CP.13.*
[6] *Decision 4/CP.15.*
[7] *Section III C of Decision 1/CP.16.*
[8] *Decision 12/CP.17.*
[9] *J. Brana-Varela, WWF Global Policy Lead, Forests & Climate, personal communication.*

Platform. The current draft decision from the UNFCCC on the FRL assessment process[10] identifies a 21-week period in which a country would submit its proposed FRL and a team of UNFCCC experts would interact with the country to complete an assessment. A key remaining issue for overall environmental integrity of REDD+ is the eventual mandate for the UNFCCC secretariat to conduct a synthesis report (or, presumably, synthesis reports) on the proposed and assessed FRLs. The draft decision will most likely form the basis for negotiations at the next COP in Warsaw, Poland, in late 2013.

FCPF Carbon Fund draft Methodological Framework

The FCPF Carbon Fund is expected to approve its Methodological Framework in December 2013 (see https://www.forestcarbonpartnership.org/carbon-fund-methodological-framework). The Methodological Framework will take a criteria-and-indicators approach to provide guidance and requirements to program proponents. The current draft criteria under development for FRLs closely parallel guidance from the UNFCCC Durban decision, with alternative approaches under consideration for addressing possible adjustments.

What is the state of play of reference level development globally?

There have been several important milestones in the development of FRLs globally. Most notably, in 2012, two major research organizations, Woods Hole Research Center (WHRC) and Winrock International (Winrock), published two global estimates of emissions from tropical deforestation (Baccini et al., 2012; Harris et al., 2012b). When accounting for the same carbon pools and for the same time frame (2000–2005), both studies estimated that gross emissions from deforestation in tropical regions contributed 3.0 Gt CO_2/yr (Harris et al., 2012a).[11] These studies created a useful benchmark at the global scale; however, they also demonstrated how different assumptions and/or approaches to estimation can significantly influence the results achieved. The following section will explore in more detail how these choices affect the design of national and subnational FRLs and the state of play of FRL implementation across six important forest countries.

Key components of reference level design

Practitioners developing national and subnational FRLs must address at least six interrelated components, the choices of which imply trade-offs and synergies in other elements (see Table 1). The following section outlines these key design considerations and describes the state of play nationally and subnationally in the implementation of these components. We highlight, with examples where possible, key challenges on the ground in implementing FRLs, areas of convergence and divergence, and barriers to scale up FRL implementation globally.

Table 1 | Key components of reference level design

forest classification	How will land and forest types be classified? How are forests stratified and sampled?
scope	What activities will be included in our FRL (e.g., deforestation, degradation, enhancement)?
scale	What are the geographic boundaries of FRL? Will it be national or subnational? How will subnational FRLs be nested within national FRLs?
pools/gases	Which pools and gases will be included in the FRL? How will this decision be used to derive emissions factors?
adjustments	How will national circumstances be taken into account?
uncertainty	How is uncertainty estimated? How will this be communicated?

[10] *http://unfccc.int/meetings/bonn_jun_2013/session/7448.php.*

[11] *Also see presentation outlining areas of consensus between these reports at http://forestemissions.org/~/media/Files/Projects/Carbon%20Emissions/Presentation%201-Deforestation%20Emissions%20in%20the%20Global%20Context.pdf.*

A brief aside: Reference level mathematics

Before we look at the technical considerations for FRL design, it is worth looking briefly at the mathematics of an FRL calculation. At its simplest level, an FRL can be expressed as the product of activity data (i.e., the change in land cover or forest cover over a given period in time) and the emissions factor (i.e., how much CO2 is emitted for that activity), expressed by the following equation:

> **emissions** *(averaged over reference period to determine reference level)* **= ∑ activity data × emissions factor**

Activity data are expressed in hectares changed per year (ha/yr) and emissions factors are expressed in tonnes of carbon dioxide per hectare (tCO_2/ha). By multiplying emissions factors and activity data, we get to an estimate of emissions in tCO_2/year.

Advancing a step further, the IPCC Guidelines for National GHG inventories (2006) provides guidance for estimating changes in carbon stocks via either the Gain Loss or the Stock Change approach. Both of these methods are valid approaches to estimating stock changes and can be applied to the development of an FRL (see Box 1).

With these simple equations in mind, let us now look at the individual steps for constructing an FRL.

Topic 1: Forest classification

Key Points

- Forest classifications are currently derived using a combination of factors such as forest type, forest age and management regime.
- Countries can choose to use different classifications from those used in their national forest inventory (NFI); however, the majority of countries are choosing to use existing classifications as the basis for their FRL development.
- Classification can be based on an analysis of the current major drivers of deforestation and forest degradation as well as an understanding of where the major threats of deforestation are likely to occur.

Forest classification is essential to FRL development, as it provides a robust basis for stratification and — through *sampling* — can reduce uncertainties in the calculation of FRLs. By grouping a country's forests into classes (i.e.,

Box 1 | Estimating changes in carbon stocks via the Gain Loss or the Stock Change approach Adapted from (IPCC, 2003)

There are two fundamentally different approaches to estimating carbon stock changes in forests:
1) the process-based approach (called the "Gain-Loss Method"), which estimates the net balance of additions to and removals from a carbon stock; and
2) the stock-based approach, which estimates the difference in carbon stocks at two points in time.

Gain-Loss Method

Annual carbon stock changes in any pool can be estimated using the Gain-Loss Method, which uses the following simple equation:

$$\Delta C = \Delta C_G - \Delta C_L$$

Where ΔC = annual carbon stock change in the pool, ΔC_G = annual gain of carbon, ΔC_L = annual loss of carbon, expressed in tonnes C yr-1.

Gains can be attributed to growth (increase of biomass) and to transfer of carbon from another pool (e.g., transfer of carbon from the live biomass carbon pool to the dead organic matter pool due to harvest or natural disturbances). Losses can be attributed to transfers of carbon from one pool to another (e.g., the biomass lost during a harvesting operation is a loss from the aboveground biomass pool) or emissions due to decay, harvest, burning, etc. The method used is called the Gain-Loss Method because it includes all processes that bring about changes in a pool.

Stock-Difference Method

The Stock-Difference Method can be used where carbon stocks in relevant pools are measured at two points in time to assess carbon stock changes, using the following equation:

$$\Delta C = \frac{C_{t_1} - C_{t_2}}{t_2 - t_1}$$

Where C_{t_1} = carbon stock in the pool at time t_1, and C_{t_2} = carbon stock in the pool at time t_2, expressed in tonnes C.

Box 1 continued

If the *C* stock changes are estimated on a per-hectare basis, then the value is multiplied by the total area within each stratum to obtain the total stock change estimate for the pool. In some cases, the activity data may be in the form of country totals (e.g., harvested wood), in which case the stock change estimates for that pool are estimated directly from the activity data after applying appropriate factors to convert to units of *C* mass. When using the Stock-Difference Method for a specific land-use category, it is important to ensure that the area of land in that category at times t_1 and t_2 is identical, to avoid confounding stock change estimates with area changes.

Gain-Loss or Stock-Difference

The Gain-Loss Method lends itself to modeling approaches using coefficients derived from empirical research. These will smooth out interannual variability to a greater extent than the Stock-Difference Method, which relies on the difference of stock estimates at two points in time. Both methods are valid so long as they are capable of representing disturbances as well as continuously varying trends, and can be verified by comparison with actual measurements.

forest types) and/or *strata,* different forest types can be assigned biomass estimates that are representative of the entire stratum. The development of biomass estimates is a key step in establishing emissions factors when moving between land use classes (e.g., from "high canopy forest" to "nonforest"). The task of forest classification can be challenging both technically and politically, as many countries have different and often competing classifications and land-cover maps in concurrent use. The Durban decision allows countries to use different definitions or classifications of forest than those used in previous international communications.[12] If a country chooses to use different definitions from those in its previous national communications, however, it must explain why these different definitions were used.

Box 2 | IPCC Approaches for land-use changes Adapted from (IPCC, 2006)

The IPCC Guidelines for National GHG Inventories describes three approaches for classifying land area. The approaches are intended to provide the area data required to develop RLs.

Approach 1 is the simplest and uses land-use area totals within a defined spatial unit, which is often defined by political boundaries, such as a country, province or municipality. Under Approach 1 only net changes in land-use area can be tracked through time. Consequently, the exact location or pattern of land-use change and the exact changes in land-use categories cannot be ascertained.

Approach 2 provides an assessment of both the net losses and gains in specific land-use categories as well as what these conversions represent (i.e., changes both from and to a category). Tracking land-use conversions in this manner will normally require estimation of initial and final land-use categories for all conversion types (e.g., Forest Land converted to Cropland), as well as of total area of unchanged land by category (e.g., Forest Land remaining Forest Land). The result of this approach can be presented as a non-spatially explicit land-use conversion matrix.

Approach 3 extends Approach 2 with spatially explicit observations of land-use categories and land-use conversions. The data may be obtained by sampling, wall-to-wall mapping techniques or a combination of these two methods. The main advantage of spatially explicit data is that analysis tools such as GIS can be used to link multiple spatially explicit data sets (such as those used for stratification) and describe in detail the conditions on a particular piece of land prior to and after a land-use conversion. This analytical capacity can improve emissions estimates by better aligning land-use categories (and conversions) with strata mapped for classification of carbon stocks and emissions factors by soil type and vegetation type.

[12] *Decision 12/CP.17.*

Forest classification is usually achieved through a two-stage process: First, a preliminary stratification is carried out with sample field plots to assess how estimates behave statistically; based on initial estimates, ideal sample sizes and strata are generated. Forests should be stratified into reasonably homogeneous types so that sample plots gathered from those areas are representative of the entire strata. The quality of the strata will be a key determinant in how accurate the carbon estimates are that are generated for each forest type. It is common practice to base such stratification on a combination of factors including forest type, soil type, topography, management regime, ecoregion, etc. In order to optimize logistical resources, forests can be further stratified according to the likelihood of deforestation of a given area; areas that are more likely to produce emissions require higher accuracies than those that are unlikely to change.

The number of *samples* will depend on the level of uncertainty needed for the FRL, which in turn depends on how heterogeneous the individual strata are. Various tools are available that can be used for this process.[13] If very large numbers of samples are required for a given stratum (because of large variance in forest areas), a reassessment of the stratification might be needed to ensure more homogeneous strata. The IPCC Guidelines for National GHG Inventories provides some guidance on how to approach this task (see Box 1), but ultimately countries will need to balance competing interests, varying resolutions and different interpretations of what types of land a country possesses.

Countries are choosing a variety of approaches to stratify their forests. Many countries are using the strata outlined in their NFIs to define forest and nonforest areas. In Vietnam, for example, land use is classified into 17 ecological zones. These classes can be collapsed into the six IPCC land-use categories as outlined in Table 3. Emissions factors are then established as the change in carbon stocks between one forest category and another, using a matrix approach (see Figure 2).

Nepal, on the other hand, classifies its forests in the Terai into three primary forest types: sal (a variety of tropical hardwood that makes up more than 70% of Nepal's lowland forests); riverine (comprising mainly Sisso and Khair); and mixed hardwood. For the purpose of stratification, however, Nepal is considering grouping forests into three strata based on Normalized Difference Fraction Index (NDFI) values derived from Landsat data and correlated to some degree with measured carbon content in forests. These three strata correspond to low-carbon forests (1–90 NDFI), medium-carbon forests (91–147 NDFI) and high-carbon forests (148–199 NDFI) with values for mean tonnes of carbon per hectare (tC/ha) derived from field plots. Emissions factors for land-use change activities are then calculated as the difference between one stratum's and another's mean carbon value (see Table 2).

Figure 2 | Forest area changes between 1990 and 2000 in the North Central region of Vietnam

	Year 2000																	
Year 1990	Evergreen broadleaf forest, rich forest	Evergreen broadleaf forest, medium forest	Evergreen broadleaf forest, poor forest	Evergreen broadleaf forest, rehabilitationr forest	Deciduous forest	Bamboo forest	Mixed timber and bamboo forest	Coniferous forest	Mixed broadleaf and coniferous forest	Mangrove forest	Limestone forest	Plantation	Limestone area (no forest)	Bare land, shub land, fragmented trees	Water body	Residential area	Other land	Grand Total
Evergreen broadleaf forest, rich forest	23,871	8,241	6,470	1,874	100	897	1,640	0	222	0	0	23	0	2,108	5	17	2,563	48,033
Evergreen broadleaf forest, medium forest	8,415	23,156	1,803	2,673	158	1,135	3,193	0	0	0	0	139	0	4,272	19	1,183	31,171	77,316
Evergreen broadleaf forest, poor forest	1,184	22,034	53,630	11,500	1,054	1,003	7,417	0	8	0	0	1,460	0	11,774	223	652	28,435	140,375
Evergreen broadleaf forest, rehabilitationr forest	348	2,734	13,117	3,893	69	886	9,182	0	229	0	0	2,551	0	5,539	20	255	17,148	55,971
Deciduous forest	74	324	718	959	47,140	0	0	0	0	0	0	6	0	5,316	45	701	14,461	69,744
Bamboo forest	6	253	477	2,812	1	4,722	9,865	0	0	0	0	563	0	3,413	5	11	1,495	23,623
Mixed timber and bamboo forest	357	7,373	8,990	7,321	7	3,558	30,794	0	1,939	0	0	1,330	0	5,094	43	11	4,905	71,722
Coniferous forest	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mixed broadleaf and coniferous forest	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mangrove forest	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Limestone forest	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Plantation	0	0	47	12	0	0	0	0	0	0	0	450	0	79	1	21	355	965
Limestone area (no forest)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bare land, shub land, fragmented trees	204	1,089	12,322	4,987	3,175	2,263	3,242	0	131	0	0	2,579	0	12,940	144	803	41,610	85,490
Water body	1	4	9	8	6	7	14	0	0	0	0	3	0	21	2,321	75	248	2,718
Residential area	0	0	8	0	0	0	0	0	0	0	0	72	0	113	9	122	466	791
Other land	10	626	1,778	3,561	233	940	1,182	0	25	0	0	1,478	0	9,866	484	7,798	47,116	75,098
Grand Total	34,470	65,833	99,371	39,600	51,943	15,411	66,527	0	2,554	0	0	10,655	0	60,535	3,320	11,651	189,974	651,844

[13] *See e.g., the Winrock Sampling Calculator: http://www.winrock.org/sites/default/files/publications/attachments/Winrock_Sampling_Calculator_20071030.xls.*

Table 2 | Potential emissions factors for changes to different strata for the Nepal FRL

Forest strata	NDFI values	Mean tC/ha	Variance	Emissions factor for changes to low carbon	medium carbon	high carbon
low carbon	1–90	25	1.08	0	34	120
medium carbon	91–147	59	0.87	–34	0	86
high carbon	148–199	145	0.61	–120	–86	0

This stratification in Nepal is still preliminary and subject to revisions based on current efforts to develop a subnational FRL for 14 million hectares in the Terai landscape (lowlands). In developing the FRL, Nepal has identified technical issues, including a weak correlation between NDFI and aboveground carbon that must be addressed prior to finalizing its FRL.

The Democratic Republic of the Congo (DRC) is still finalizing its forest classification, while Costa Rica is considering distinguishing its forest areas for an FRL based on the ownership and age of forests (early regeneration, mid-regeneration, old growth).

Topic 2: Scope

Key Points

- Currently, countries are exploring both land-based and activity-based approaches to develop forest FRLs. Under an activity-based approach, countries should avoid double-counting emission reductions if a given area is subject to multiple activities.
- Countries are adopting a wide range of approaches for the choice of activities to include in an FRL. Some countries have chosen to only include deforestation, whereas others have included degradation and enhancement.

Land-based versus activity-based accounting

When designing a national or subnational FRL, countries can initially choose to use either a *land-based* or *activity-based* accounting system (IPCC, 2000).

Under a **land-based** approach, accounting is based on the total change in carbon stock on land units subject to REDD+ activities. Implementing this rule involves first identifying land units on which applicable activities occur. Next, the total change in carbon stocks on these land units is determined. Aggregate emissions or removals are the sum of stock changes over all applicable land units.

An **activity-based** approach begins with the carbon stock changes attributable to agreed-upon activities. Each applicable activity's impact on carbon stocks is determined per unit area, which is then multiplied by the area on which that activity occurs. Aggregate emissions or removals are calculated by summing across all activities. Under an activity-based approach, care needs to be taken to avoid a given area of land being counted more than once if it is subject to multiple activities.

Table 3 | IPCC Land-Use Categories and Conversions Between Categories
Conversions in shaded area follow the following nomenclature: FF = Forest Land remaining Forest Land, CW = Cropland converted to Wetland and so on.

	Forest Land	Cropland	Grassland	Wetlands	Settlements	Other Land
Forest Land	FF	FC	FG	FW	FS	FO
Cropland	CF	CC	CG	CW	CS	CO
Grassland	GF	GC	GG	GW	GS	GO
Wetlands	WF	WC	WG	WW	WS	WO
Settlements	SF	SC	SG	SW	SS	SO
Other Land	OF	OC	OG	OW	OS	OO

Under either a land-based or an activity-based approach, countries should attempt to identify and include the major activities that are causing emission reductions or removals and include these in the FRL calculation. Activity data can be derived from remote sensing products (e.g., satellite or airplane mounted) that estimate how many hectares of a certain forest type are lost, degraded or enhanced or from other ancillary data (e.g., national forest inventories or timber and other agricultural production records).

The IPCC defines six land-use categories and 30 land-use conversions that are considered under LULUCF accounting (see Table 3). Countries will need to identify which of these six land-use categories they are going to use in creating FRLs.

A range of approaches is currently being explored by countries in calculating their FRLs. Costa Rica, for example, a country with historically low rates of deforestation, has chosen to use a combination land-based and activity-based approach to develop its FRL. The Costa Rican FRL is composed of a combination of avoided deforestation in old-growth and secondary forests, plantations on nonforest land, and sequestration from harvested wood products. Nepal, on the other hand, has chosen to use a land-based approach for carbon accounting. The Nepal FRL addresses an area known as the Terai Arc Landscape (TAL) and will use satellite monitoring ground-truthed with field measurements to derive changes in land use. DRC, Vietnam and Indonesia are considering land-based approaches to their initial FRL development.

RED or REDD+

The UNFCCC defines five activities under the scope of REDD+:[14] deforestation, degradation, enhancement, conservation and the sustainable management of forests. Decision 12/CP.17 requested countries when developing their FRLs to submit information on *"Pools and activities … which have been included in [FRLs] and the reasons for omitting a pool and/or activity from the construction of [FRLs], noting that significant pools and/or activities should not be excluded."* Decision 12 also noted that FRLs are an iterative process and that a country can *"update a [FRL] periodically as appropriate, taking into account new knowledge, new trends and any modification of scope and methodologies."*

Countries are adopting a wide range of approaches in the choice of activities that they are including in their FRLs. Acre, Brazil, for example, has chosen to include only deforestation, as this is the predominant land-use change and cause of GHG emissions in the state. The federal government of Brazil is in the process of developing a national forest monitoring system, known as DEGRAD, that will enable satellite monitoring of degradation, and the FRL may subsequently be improved to reflect these improved data. Nepal, on the other hand, is considering including all activities in its FRL assessment. Nepal is trying to calculate net changes in forest carbon stocks for all forests in the Terai landscape, encompassing deforestation, forest degradation, regrowth and enhancement.

Topic 3: Scale

Key Points

- Many countries are developing subnational FRLs for a variety of reasons (political, technical and practical).
- When developing FRLs at multiple levels, a minimum level of consistency in data sources, methodologies and adjustments will be important moving forward, to avoid complicated, costly and difficult reconciliation at the national level.
- Where subnational FRLs are being developed, it may be necessary to establish rules for the accounting of emissions and the delivery of finance between the national and subnational levels.

Given the ambiguity in international policy on the implications of differing scales of FRLs, countries will need to decide at an early stage what their objectives are in establishing an FRL. For example, they will need to decide whether they want to submit a national or subnational FRL(s) to the UNFCCC, whether and how to integrate with domestic climate policy or cap-and-trade initiatives, and whether to pursue results-based financing (and from what finance instruments) based on subnational or national FRLs. This decision could be based on a range of factors including a country's level of centralization/decentralization, its capacity to develop FRLs at scale, or jurisdictional boundaries and where forests are located within a country.

[14] *Decision 1/CP.16 para 70, although SFM and conservation might easily be omitted from this list as they are essentially the absence of forest degradation and deforestation, respectively.*

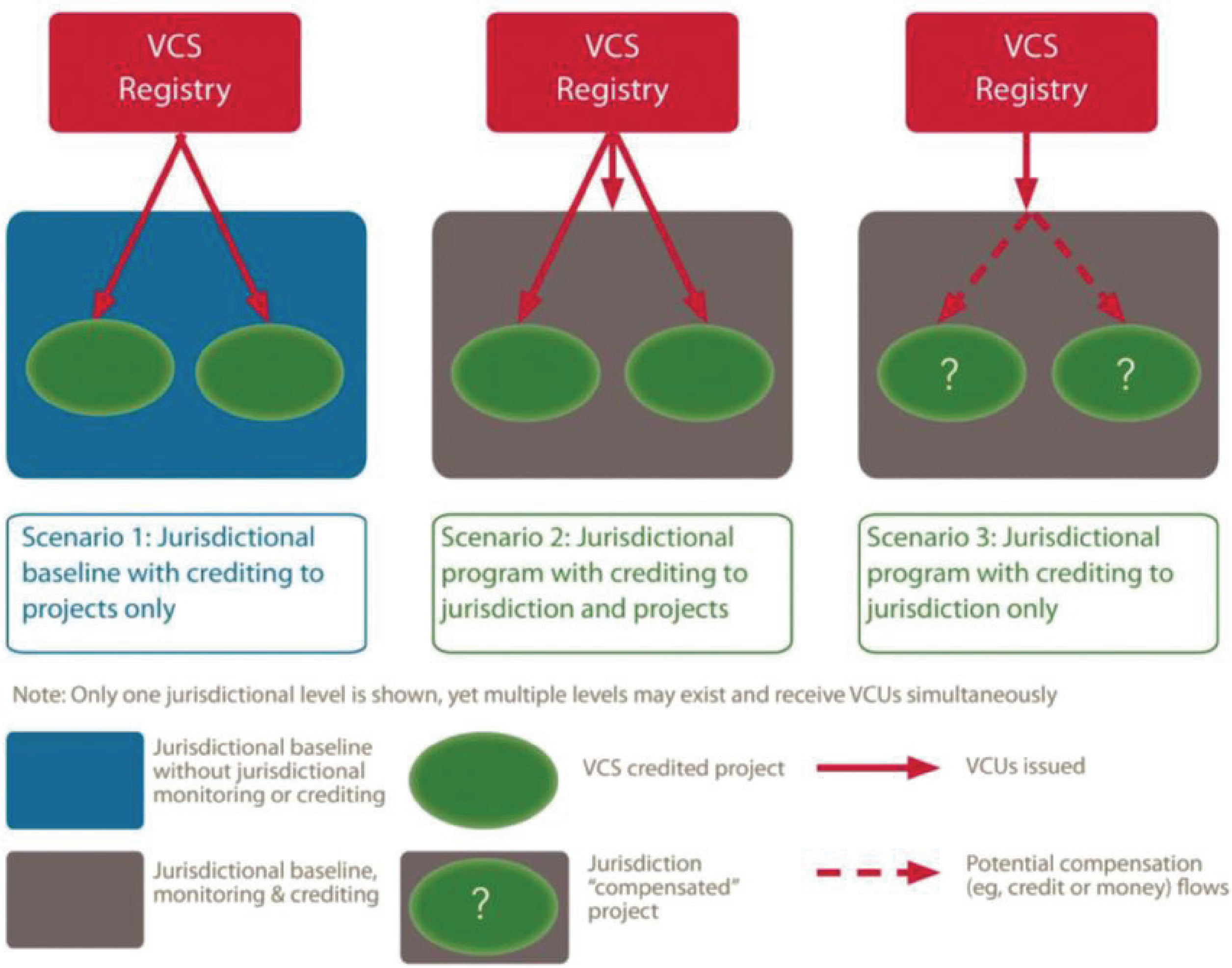
REDD+ country participants also suggested that subnational FRLs are helpful to develop a more detailed understanding of the local and regional drivers of deforestation.

There is no silver bullet for the choice of scale of FRLs within a country. In countries like Brazil, for example, where states cover vast areas and have unique authorities over land management (particularly those lands with significant deforestation), the alignment of subnational FRLs with state boundaries might be a logical choice. In countries with smaller jurisdictions, however, such as Nepal, which has 76 districts, other options that are based on physiological (e.g., altitudinal) or ecological boundaries (e.g., based on endangered species' habitats or a single ecosystem or forest type) may be more appropriate. Combinations of these considerations may also be appropriate (e.g., a collection of administrative units that collectively comprise an ecoregion).

Nesting

A country or jurisdiction choosing to implement FRLs at different scales in a country faces the challenge of ensuring vertical consistency, e.g., in the case of a subnational jurisdiction, it may need to manage *downward* to integrate with project-level FRLs and *upward* to be consistent with national-level FRLs. This process is known as *nesting*. Nesting serves two major purposes: first, it ensures that emission reductions are accounted for only once within a country. If a country and state both claim emission reductions for the same activity (i.e., *double counting*), the climate integrity of the REDD+ mechanism would be undermined. Second, it allows a process for finance and benefits to be transferred to actors at different levels. The VCS has developed a Jurisdictional and Nested REDD methodology that outlines some ways in which this can be achieved (see Figure 3).

Figure 3 | Simplified scenarios for how finance and ERs could be credited between national and subnational FRLs (VCS, 2012)



In Brazil, Nepal, Indonesia, DRC and Vietnam, FRLs are being developed concurrently at the national and subnational levels.[15] Costa Rica's FRL to the Carbon Fund will include all but Guanacaste province, thus covering about 75% of the national area. While the choice to develop subnational FRLs may be motivated by the desire to access finance and to manage any REDD+ program, there are other reasons REDD countries are developing these subnational FRLs.

In Nepal, for example, substantially more data exist for the lowland forests bordering India (known as the Terai) than for the high mountain forests. The government of Nepal is therefore developing an interim subnational FRL for the lowland region first, based on the jurisdictional boundaries of 12 districts, which will form the basis of a subnational REDD+ program.

In Brazil and Indonesia, some state and provincial governments are developing subnational REDD+ programs. In Brazil, the federal government has requested each of the nine states in the Brazilian Amazon to develop a Plan for Prevention and Control of Deforestation (PPCD). As part of their plan to address deforestation, each state may develop its own FRL. In the state of Acre, higher-resolution data than those used for the Amazon Fund FRL produced higher historical rates of deforestation, but Acre has agreed to use the national data for its FRL in order to be consistent and "nest" within the national system. Data compatibility is one of many challenges countries will face when harmonizing FRLs across scales.

In Indonesia, the central government is considering allocating a proportion of the total permissible national deforestation and associated emissions to individual provinces, holding public consultations on these allocations, and asking provinces to develop their own FRLs for their allocation. Through this bottom-up process, certain provinces have developed projected FRLs (see Topic 5: Adjustments), while the national government is using a historical FRL and encouraging the use of projections. The government of Indonesia now faces a major challenge to reconcile these two approaches so that the aggregate emissions can be in agreement with those the central government has allocated.

Vietnam is developing subnational FRLs but is unlikely to have challenges with nesting, since it is using national forest inventory data (including forest maps, field measured data, emissions factors, etc.) and consistent methodologies to calculate historical FRLs.

Topic 4: Pools and Gases

Key Points

- Countries have elected to choose a wide range of pools and gases in their FRL development.
- Some countries have chosen to omit soil organic matter because of concerns about uncertainty, whereas others have chosen to include all pools. Only one country is currently considering harvested wood products in its FRL design.

Countries will need to establish the pools and gases that will be included in the FRL calculation to derive emissions factors. The IPCC recognizes three gases (carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O)) and five carbon pools for LULUCF (IPCC, 2006).[16] The five carbon pools are shown in Table 4 below:

Decision 12/CP.17 requires countries to submit information on all pools and gases and provide reasons where pools have been excluded. Given this broad framework and choice of methods for calculating forest carbon changes outlined in Box 1, countries have a variety of ways to determine how to include pools and gases into their FRL calculations. Emissions factors for these pools can then be generated through either default values (IPCC Tier 1 provides default values for broad classes of land throughout the world) or more precise estimates that could be generated using plot data, field measurements, and allometric equations that convert plot measurements to biomass or carbon estimates.

Indonesia has derived its emissions factors from emissions or removals calculated for the average data sample for each activity and each time period (stock difference method). In 2011, the Ministry of Forestry, in collaboration with UN-REDD Programme Indonesia, began redesigning the NFI to include measurements of carbon stocks and will extend the focus beyond measurement of commercial timber. The inventory will include all five carbon pools, including emissions from peat and peat fires, through a combination of default values and sampling. Both Acre state in Brazil and

[15] *At the time of writing, only Costa Rica is implementing an FRL solely at the national scale.*
[16] *In addition, countries may choose to define harvested wood products (HWP) as an additional pool.*

Table 4 | Definitions for Carbon Pools Used in AFOLU for Each Land-Use Category

Group	Pool	Description
Biomass	Above-ground biomass	All biomass of living vegetation, both woody and herbaceous, above the soil including stems, stumps, branches, bark, seeds and foliage. In cases where forest understory is a relatively small component of the aboveground biomass carbon pool, it is acceptable for the methodologies and associated data used in some tiers to exclude it, provided the tiers are used in a consistent manner throughout the inventory time series.
	Below-ground biomass	All biomass of live roots. Fine roots of less than 2 mm diameter are often excluded because these often cannot be distinguished empirically from soil organic matter or litter.
Dead organic matter (DOM)	Deadwood	Includes all nonliving woody biomass not contained in the litter, either standing, lying on the ground or in the soil. Deadwood includes wood lying on the surface, dead roots and stumps larger than or equal to 10 cm in diameter (or the diameter specified by the country).
	Litter	Includes all nonliving biomass with a size greater than the limit for soil organic matter (suggested 2 mm) and less than the minimum diameter chosen for deadwood (e.g., 10 cm), lying dead, in various states of decomposition, above or within the mineral or organic soil. This includes the litter layer as usually defined in soil typologies. Live fine roots above the mineral or organic soil (of less than the minimum diameter limit chosen for belowground biomass) are included in litter where they cannot be distinguished from it empirically.
Soils	Soil organic matter (SOM)	Includes organic carbon in mineral soils to a specified depth chosen by the country and applied consistently through the time series. Live and dead fine roots and DOM within the soil that are less than the minimum-diameter limit (suggested 2 mm) for roots and DOM are included with soil organic matter where they cannot be distinguished from it empirically.

Nepal are considering both above-ground and below-ground biomass, but given the uncertainty and cost associated with measurements, have not thus far looked at including dead organic matter (DOM) and soil organic matter (SOM). Costa Rica is currently the only country to include harvested wood products in its FRL design, and as a low-forest-cover, low-deforestation (LFLD) country, Costa Rica has additionally included enhancement (through regrowth as well as afforestation/reforestation) in its FRL calculation (using the gain-loss method).

Topic 5: Adjustments

Key Points

- Adjustments may be used to account for a country's changes in deforestation and/or degradation as compared with historical rates; however, policy discussions at the UNFCCC and climate initiatives like the FCPF Carbon Fund suggest that these are likely to be strictly defined and/or constrained.
- Adjustments should be fully explained and will likely require more data-intensive analysis than historical deforestation rates require.
- Adjustments can be either upward or downward depending on a country's projected business-as-usual scenario. Only Brazil and Costa Rica, to date, have proposed a downward adjustment to their FRLs.
- Adjustments can be simple (e.g., a line through a data series) or complex (e.g., modeling using a set of national or subnational development assumptions). More complex approaches will most likely require additional technical capacity.

FRLs reflect historical rates of emissions and aim to estimate the net quantity of greenhouse gas (GHG) emissions that *would have occurred* in the absence of a REDD+ intervention in the future. They also seek to provide two key functions: maintaining climate integrity and providing a benchmark for the delivery of finance. Given that deforestation and degradation rates change over time (Rudel et al., 2005), historical FRLs may not be the most appropriate or fair benchmark for countries' future performance (e.g., for countries with historically high or low deforestation rates).

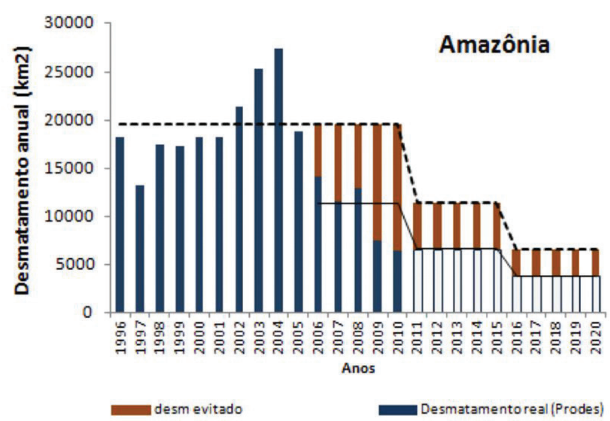
Recognizing this, the UNFCCC decisions allow for countries to make *adjustments* to their historical data. These adjustments have not been formally defined, but a variety of proposals have been put forward to elaborate how FRLs might be adjusted to accommodate for different circumstances. These include adjustments potentially against global averages, payments for carbon stocks, and projections based on models that describe or predict future threats (Busch et al., 2009; Griscom et al., 2009). The use of projections is also closely tied with the discussion on compensation for HFLD countries (Fonseca et al., 2007). The use of modeling will introduce the need for more complex FRL submissions to the UNFCCC and will almost certainly require additional technical capacity. As agreed in Decision 12/CP.17, for any adjustment to historical data, countries will need to transparently state and provide justification for their assumptions.

The question of how and if adjustments are needed is a divisive issue in FRL discussions. Some argue that FRLs should be purely historical, because these a) are the simplest technically to construct; b) adequately reflect future behaviors; and c) may maximize environmental integrity (particularly in the absence of a global mechanism that ensures net reductions from historical levels while providing finance opportunities for countries experiencing different levels of deforestation and degradation). Others argue that even historical FRLs are a projection of sorts and include many assumptions of their own (e.g., stable rates of deforestation, consistent levels of economic development and constant demand for commodities that drive deforestation). It is worth noting that project-level initiatives have gravitated toward projected FRLs (primarily for reasons of attribution and because higher levels of crediting result), whereas the UNFCCC-linked processes have gravitated more toward historical FRLs (including adjustments), as this is more comparable to an Annex I commitment of some percentage reduction below a base year (typically 1990).

Many countries and states are still deciding how to implement adjustments to their FRLs. DRC, for example, has decided to adjust at both the national and the subnational levels. The FRLs will be built up from national activity data overlaid on subnational boundaries that are defined by geographically and economically homogenous units. For each unit, projections will be developed through an analysis of trends in the drivers of deforestation. Costa Rica has also adjusted its FRL based on a projected fourfold increase in storage through HWPs, highlighting that projections need not be implemented for all pools or activities. Nepal is one country that is unlikely to adjust its FRL and is considering a simple subnational historic FRL.

Brazil is the only country to date that has proposed a downward adjustment. The national FRL was constructed using historical data from 1996 to 2005. The FRL will be updated every five years, through a rolling historical average, to establish new targets. The result is a downward adjustment every five years if deforestation in the Amazon decreases (see Figure 4).

Figure 4 | Brazil's national RL, which uses a historical rolling average, will be adjusted every five years to reflect changes in deforestation in the country



Topic 6: Uncertainty

Key Points

- Numerous sources of error contribute to considerable uncertainty in FRL estimates, in some cases at a magnitude comparable to anticipated emission reductions.
- Many countries currently lack the capacity to implement uncertainty analysis in the FRL calculation.
- Most countries have not yet attempted to derive robust uncertainties for their preliminary FRLs.
- Conservative accounting approaches can provide a stepwise approach to improving accuracy while also leveraging additional finance.

Participants discussed numerous sources of error in FRL estimates and the technical challenges of trying to minimize these and quantify their effects on uncertainty estimates. For example, a study was discussed showing that allometric models (equations to convert ground forest plot data to estimated biomass) can impact estimates by over 100%. This can lead to situations where even significant emission reductions from REDD+ interventions are not detectable beyond confidence intervals.

Uncertainty analysis for FRLs can be broken into four types (IPCC, 2003):

- Uncertainties in individual variables used in the FRL (e.g., estimates of emissions from specific categories, emissions factors, activity data)
- Aggregating the component uncertainties (error propagation)
- Determining the uncertainty in the trend, i.e., the uncertainty around the number of emission reductions produced
- Identifying significant sources of uncertainty to help prioritize data collection and efforts to improve the inventory

Given the uncertainty around forest-based emissions, FRL estimates should be reported transparently with indications of statistical uncertainty. The IPCC Guidelines (IPCC, 2006) and Good Practice Guidance for LULUCF (IPCC, 2003) provide guidelines for countries to develop statistically robust estimates of emissions and their associated uncertainties. However, many participants expressed concerns that this guidance is not sufficient.

One of the aims of uncertainty analysis is to define ways to reduce uncertainty. Depending on the cause of uncertainty present, uncertainties could be reduced in various ways (IPCC, 2006):

- **Improving conceptualization:** Improving the inclusiveness of the structural assumptions chosen can reduce uncertainties. An example is better treatment of seasonality effects that leads to more accurate annual estimates of emissions or removals for the AFOLU sector.
- **Improving models:** Improving the model structure and parameterization can lead to better understanding and characterization of the systematic and random errors, as well as reductions in these causes of uncertainty.
- **Improving representativeness:** This may involve stratification or other sampling strategies. This is particularly important for categories in the agriculture, forestry and land-use parts of an inventory but also applies elsewhere, e.g., wherever different technologies are operating within a category.
- **Using more precise measurement methods:** Measurement error can be reduced by using more precise measurement methods, avoiding simplifying assumptions, and ensuring that measurement technologies are appropriately used and calibrated.
- **Collecting more measured data:** Uncertainty associated with random sampling error can be reduced by increasing the sample size. Both bias and random error can be reduced by filling in data gaps. This applies to both measurements and surveys.
- **Eliminating known risk of bias:** This is achieved by ensuring instrumentation is properly positioned and calibrated and models or other estimation procedures are appropriate and representative as indicated by the decision trees and other advice on methodological choice in sectoral volumes, as well as by applying expert judgments in a systematic way.
- **Improving state of knowledge:** Generally, improving the understanding of the categories and the processes leading to emissions and removals can help to discover, and correct for, problems of incompleteness. It is good practice to continuously improve emissions and removal estimates based on new knowledge.

Several points and questions were discussed, including the following:

- Uncertainty may be easier to limit and quantify with carbon stock increments.
- In the case of FRLs, precision (consistency of estimates) may be more important than accuracy (how close estimates are to the "true" value) because it is the change in emission reductions over time that is essential to quantify. If consistent methodologies are used at the beginning and end of the reference period, methodological bias can be reduced. Similarly, estimates should not be double-penalized for uncertainty around endpoints, because it is the uncertainty of the change that is critical.
- The distribution of error sources and efforts to address them are important. Some errors, e.g., those associated with areas of high deforestation, are essential to minimize, while others may be of limited significance to FRL estimates and require little or no mitigation.
- In many cases, the extent of uncertainty may not be a barrier to finance. If early estimates have broad confidence intervals, using the lower end of the confidence interval for determining compensation may result in lower initial payments but can position a country to continually improve estimates.

Developing countries will almost certainly need to develop technical capacity to derive uncertainty estimates using the IPCC guidelines. For the most part, countries have either not yet begun to include uncertainty analysis in their FRL calculations or have developed only preliminary approaches to address the question of uncertainty.

Conclusions

The workshop held in Washington, D.C., in January 2013 provided a diverse and neutral forum for countries and states and civil society to share their experiences in the development of national and subnational FRLs. Participants from academia, civil society, the private sector, multilateral REDD+ funds, and governmental and intergovernmental organizations expressed a wide range of views on the technical and political aspects of FRL implementation.

In the brief time available for the workshop, the intent was not to solve major problems or develop guidelines for new policy but rather to discuss the progress made and the questions and barriers encountered by those working on the ground to develop FRLs, and to provide some sense of the "state of play" in FRL development. This section draws together key lessons harvested from the discussions to inform both the emerging process of FRL implementation as well the ongoing policy discussions on FRL design.

- **One tool, multiple purposes:** Participants presented during the workshop a variety of reasons why FRLs are important. Many countries highlighted the importance of FRLs for planning and management purposes, to identify areas where intervention strategies need to occur. Countries also highlighted the central role FRLs play in establishing the additionality of emission reductions. How additionality was defined, however, varied among participants. Participants agreed that FRLs are an important tool for establishing the level of finance a country might receive; discussions reflected a variety of approaches for how this might be achieved.
- **Flexibility in design:** Developing countries face a huge diversity in both national and local circumstances when implementing REDD+. This diversity is reflected in the range of approaches that workshop participants are following in their design and implementation of FRLs. Across the six major pillars of FRL design, countries have adopted a broad interpretation of how they would implement these various options. Policymakers may view this as an opportunity to develop a system that accommodates the varying needs of REDD+ countries. Flexibility will be an essential feature in the design of international FRL policy frameworks.
- **Need for early piloting in the UNFCCC context:** Countries could benefit from some early FRL submissions to the UNFCCC because they would trigger the UNFCCC technical assessment process. These early submissions will require the UNFCCC to consider various approaches, data sources, and methodological quality and consistency, as well as whether and how to provide guidance on allowable adjustments.
- **Detailed guidelines and guidance:** International policy guidance on FRLs still allows substantial room for interpretation. Many elements of FRL design are still poorly elaborated in how they should be operationalized at the national or subnational level. Noting the need for flexibility in design stated above, detailed guidelines should be developed that clearly outline how international FRL policy should be implemented. This should take into account existing guidance and guidelines including those already produced by the Intergovernmental Panel on Climate Change.
- **Technical capacity:** There continues to be a lack of technical capacity to effectively implement FRLs. REDD+ countries, through their readiness process, have made steps to increase their technical capacity to implement FRLs, but many of these countries still have too few technical experts with too many competing demands on their time to be able to effectively implement FRLs at the national and subnational level. Similarly, at the international level there are only a handful of FRL experts available to participate in key processes including, e.g., the technical review and assessment of FRLs and the development of detailed guidelines for FRL operationalization.
- **Stepwise approach:** For many of the reasons stated above, it is unlikely that the first submissions of subnational and national FRLs will be technically complete. Many countries will need to iteratively improve their FRLs over time. Since stepwise iterations of FRLs are unlikely to correlate exactly with previous versions, this will create some challenges for the implementation of FRLs. First, donors may establish expectations for the amount of emission reductions that can be achieved from REDD+ interventions based on a submitted FRL. An update to the methodologies, science or data may yield

a different result than early estimations, thereby changing expected outcomes. Second, given the strong interdependence between FRLs and MRV systems, any changes to the design of FRLs will mean further considerations in the design of MRV systems. Finally, given the trade-off in the cost and accuracy of FRL systems, countries should consider carefully the level of investment in early FRL systems. Not letting the perfect be the enemy of the good will be important for early FRL implementation.

- **Sharing experiences:** During this critical period when countries are piloting their national and subnational FRLs, South-South learning and information exchange platforms will be essential. Many participants expressed a need for more training and workshops, to share experiences and discuss in detail how some of the emerging initiatives have been successful and could be scaled up to progress FRL development across other countries. Opportunities for sharing lessons from ongoing experience will also help inform the policy discussion occurring in multiple arenas on the FRL design and operationalization.

Annexes

Annex I: Bibliography

ANGELSEN, A., BOUCHER, D., BROWN, S., MERCKX, V., STRECK, C. & ZARIN, D. 2011. Modalities for REDD+ Reference Levels: Technical and Procedural Issues. Meridian Institute.

BACCINI, A., GOETZ, S. J., WALKER, W. S., LAPORTE, N. T., SUN, M., SULLA-MENASHE, D., HACKLER, J., BECK, P. S. A., DUBAYAH, R., FRIEDL, M. A., SAMANTA, S. & HOUGHTON, R. A. 2012. Estimated carbon dioxide emissions from tropical deforestation improved by carbon-density maps. Nature Climate Change, 1354.

BUSCH, J., STRASSBURG, B., CATTANEO, A., LUBOWSKI, R., BRUNER, A., RICE, R., CREED, A., ASHTON, R. & BOLTZ, F. 2009. Comparing climate and cost impacts of reference levels for reducing emissions from deforestation. Environmental Research Letters, 4.

FONSECA, G. A. B. D., RODRIGUEZ, C. M., MIDGLEY, G., BUSCH, J., HANNAH, L. & MITTERMEIER, R. A. 2007. No forest left behind. PLoS Biology, 5, 216.

GRISCOM, B., SHOCH, D., STANLEY, B., CORTEZ, R. & VIRGILIO, N. 2009. Sensitivity of amounts of distribution of tropical forest carbon credits depending on baseline rules. Environmental Science and Policy, 12, 897–911.

HARRIS, N., BROWN, S., HAGEN, S. C., BACCINI, A. & HOUGHTON, R. 2012a. Progress toward a Consensus on Carbon Emissions from Tropical Deforestation.

HARRIS, N. L., BROWN, S., HAGEN, S. C., SAATCHI, S. S., PETROVA, S., SALAS, W., HANSEN, M. C., POTAPOV, P. V. & LOTSCH, A. 2012b. Baseline map of carbon emissions from deforestation in tropical regions. Science, 336, 1573–1576.

IPCC 2000. IPCC Special Report: Land Use, Land-Use Change, and Forestry. IPCC.

IPCC 2003. Good Practice Guidance for Land Use, Land-Use Change and Forestry. Kanagawa, Japan: IPCC National Greenhouse Gas Inventories Programme and Institute for Global Environmental Strategies (IGES).

IPCC 2006. Guidelines for National Greenhouse Gas Inventories, Prepared by the National Greenhouse Gas Inventories Programme. In: EGGLESTON, H. S., BUENDIA, L., MIWA, K., NGARA, T. & TANABE, K. (eds.). IGES, Japan.

RUDEL, T. K., COOMES, O. T., MORAN, E., ACHARD, F., ANGELSEN, A., XU, J. & LAMBIN, E. 2005. Forest transitions: towards a global understanding of land use change. Global Environmental Change, 15, 23–31.

VCS 2012. Jurisdictional and Nested REDD+ (JNR) Requirements. Requirements Document. Version 3 ed.

Annex II: Workshop Participants

The following table presents a list of participants who attended the workshop.

Attendee	Affiliation
Naikoa Aguilar-Amuchastegui	WWF U.S.
Ken Andrasko	FCPF Facility Management Team
Virni Budi Arifanti	Indonesia Ministry of Forestry
Jonah Busch	Conservation International
Pham Cuong	Vietnam Administration of Forestry
Resham Dangi	Nepal REDD Cell
Christine Dragisic	U.S. Department of State
Leslie Durschinger	Terra Global Capital
Jeff Fiedler	The Nature Conservancy
Wojtek Galinski	UNFCCC Secretariat
Lloyd Gamble	WWF U.S.
Bruno Guay	FCPF Facility Management Team
Matt Hansen	University of Maryland
Nancy Harris	Winrock International
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Jean-Paul Kibambe	(DRC) Université Catholique de Louvain
Rajesh Koirela	FCPF Facility Management Team
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Lou Leonard	WWF U.S.
Alex Lotsch	FCPF Facility Management Team
Ugan Manandhar	WWF Nepal
Santosh Nepal	WWF Nepal
Dan Nepstad	IPAM
John O. Niles	WWF U.S.
Evan Notman	USAID
Robert O'Sullivan	Forest Carbon, Markets and Communities Program
German Obando	(Costa Rica) Earth University
Charlie Parker	WWF U.S.
Catherine Potvin	McGill University
Krishna Chandra Paudel	Nepal Ministry of Forests and Soil Conservation
Gordon Smith	Wildlife Works
Brent Sohngen	Ohio State University
Arief Wijaya	Center for International Forestry Research

Annex III: Workshop Agenda

The following is the agenda that was sent to participants.

"Building REDD+ Reference Levels" — a WWF-FCPF Technical Workshop
January 28 afternoon and January 29, 2012

Each technical session will be facilitated by a selected participant, who will use information collected in advance to organize a discussion of different technical approaches, challenges, lessons learned and needs identified around the particular component of reference level development.

Day 1

1:00	Welcome (WWF and FCPF) and logistics
1:15	Scope and objectives
1:30	Introductions of participants
1:45	Background
2:15	Steps for developing FRLs (including decision tree of FCPF-Winrock FRL Tool)
2:45	Identification of priority challenges and needs
3:15	Break
3:30	Technical session 1 — Identifying activities to include in FRL (deforestation, degradation, enhancement)
4:45	Technical session 2 — Selection of forest classification
6:00	Close and reception

Day 2

8:30	Coffee and eats
8:45	Review of Day 1 and introduction to Day 2
9:00	Technical session 3 — Selection of scale, boundaries and alignment of subnational and national efforts
10:30	Break
10:45	Technical session 4 — Emissions factors and selection of pools, gases
12:15	Lunch (on-site)
1:15	Technical session 5 — Relation to national forest inventory
2:45	Break
3:00	Technical session 6 — Adjusting for national circumstances
4:30	Synthesizing priority challenges and needs and considerations around UNFCCC submission
5:45	Close

Annex IV: Contacts

For more information on this workshop and to view the presentations, visit http://wwf.panda.org/what_we_do/footprint/forest_climate2/events/.

The organizers are eager to find ways to continue these important conversations in the future as guidance, capacity and the science to develop REDD+ reference levels continue to evolve. If you have any suggestions, questions or comments, please contact:

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For more information on this workshop and to view the presentations, visit:

- **http://wwf.panda.org/what_we_do/footprint/forest_climate2/events**

You will also find useful additional information at the following websites:

- **http://www.forestcarbonpartnership.org**
- **http://wwf.panda.org/forestclimate**
- **http://reddcommunity.org**

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