



Food and Agriculture
Organization of the
United Nations



Technical Annex for REDD+ results

Forest Carbon Partnership Facility Programme
FAO Technical Cooperation Programme

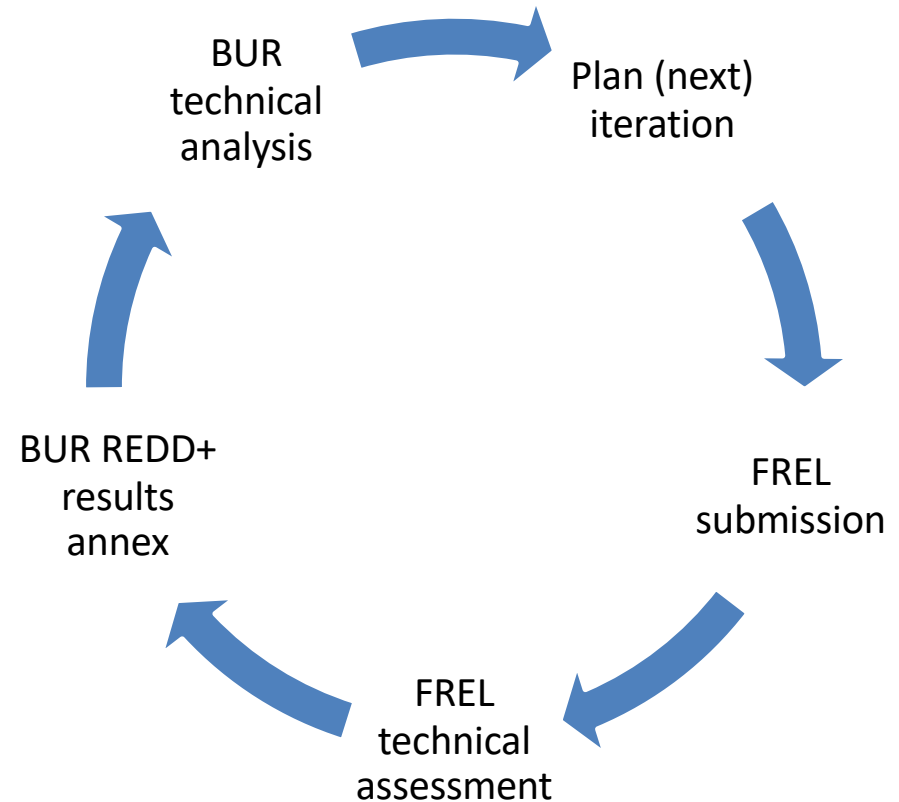
Desimination Workshop on 1st BUR in Cambodia
10th September 2020

Prepared by :

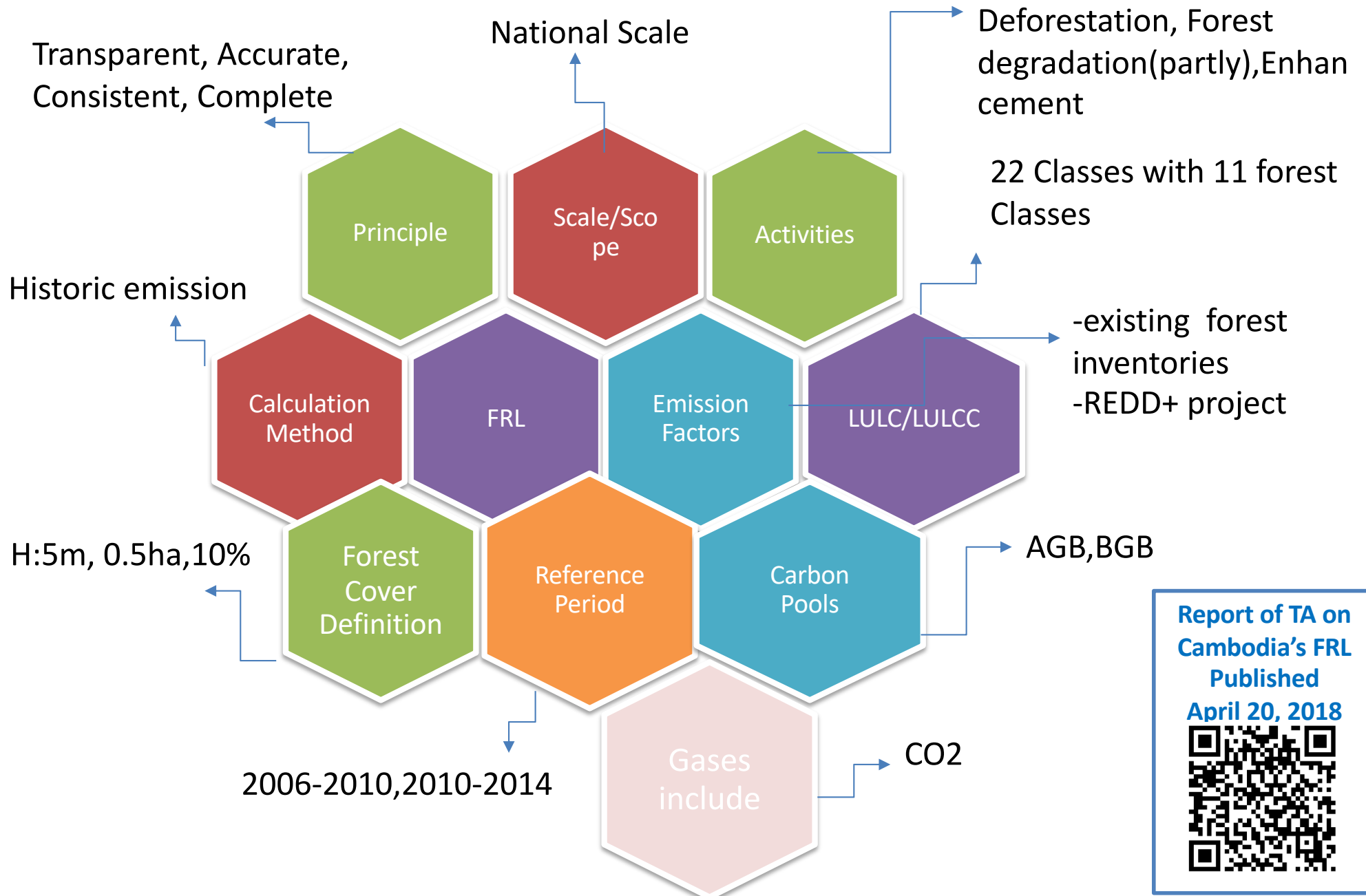
- MRV T-T
- FAO
- FCPF II /UNDP

REDD+ results reporting to the UNFCCC

- **REDD+ results are reporting in a Technical Annex (TA) to the BUR**
- **The principal objective** of the TA is to report on progress made [and results achieved] by Cambodia on Reducing Emissions from Deforestation, Forest Degradation and through Enhancements of Forest Carbon Stocks over 2015 to 2018 as Cambodia is transitioning from a REDD+ readiness phase to REDD+ demonstration and full implementation
- **Key objectives** of the TA are also to make information available for public, scientific use and other purposes to contribute to our understanding and to improved natural resource use in Cambodia.



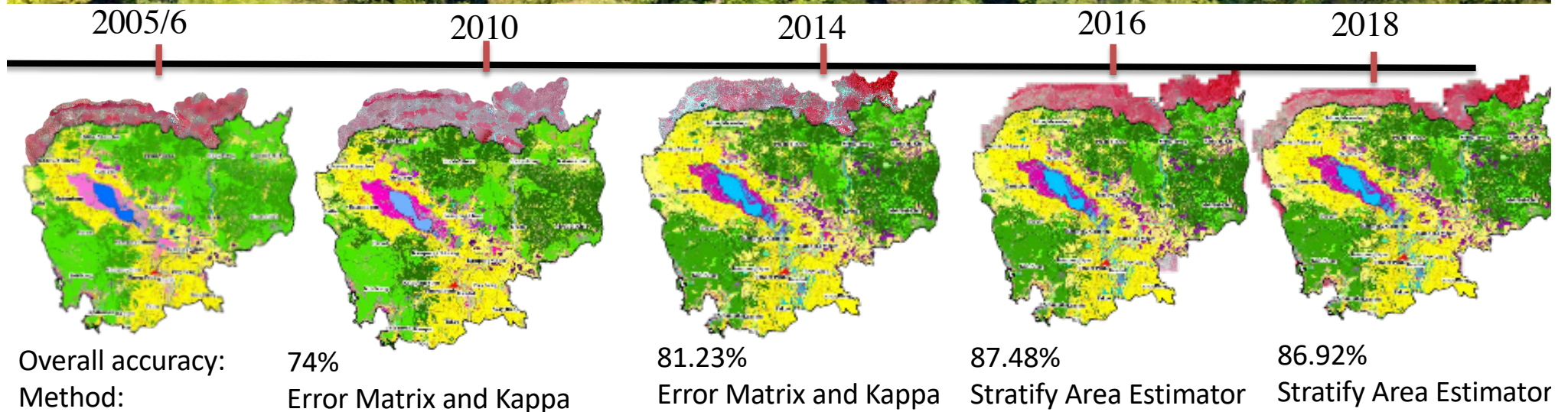
Summery CAMBODIA Forest Reference Level (FRL) Development



Report of TA on Cambodia's FRL Published April 20, 2018



Activity Data



FRL Reference Period

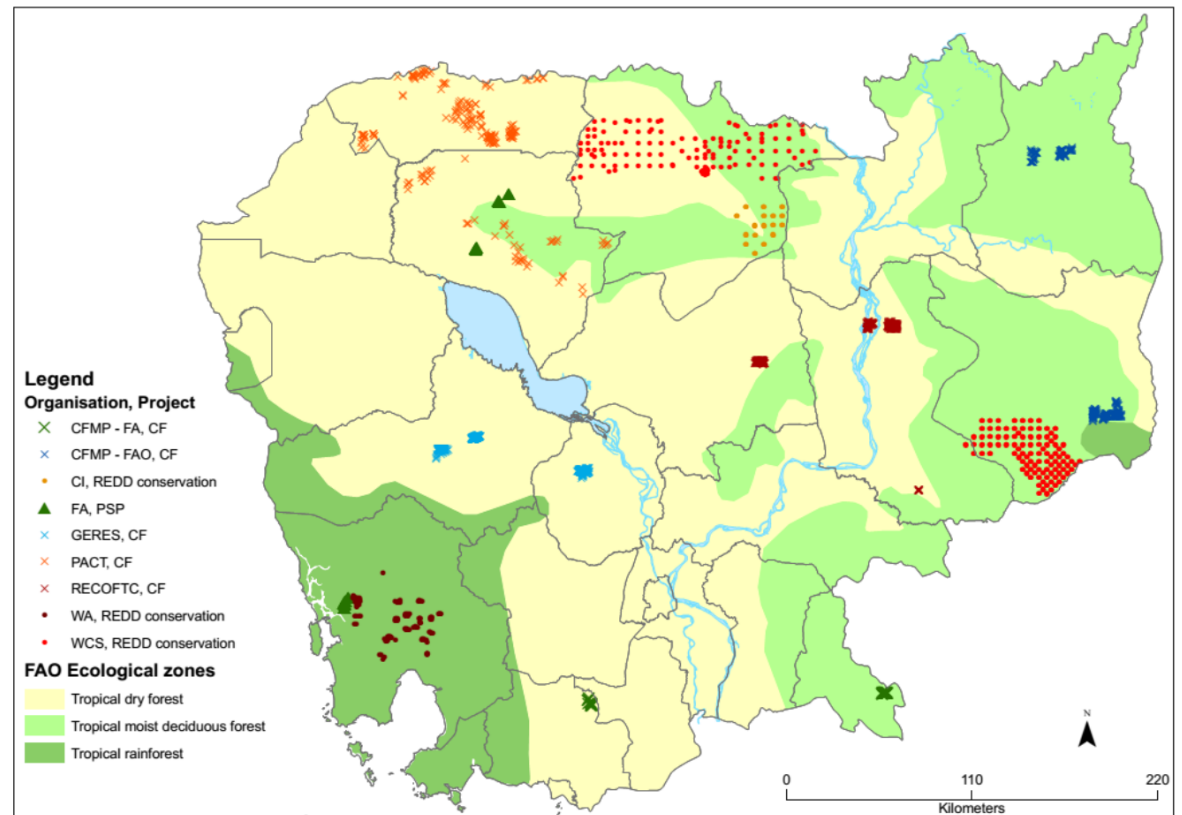
- As the baseline map, “2014 map” (LANDSAT 8).
- Two Historical maps are used to derive historical land use and carbon stock change :
 - a) Upgrading of existing 2006 and 2010 (FA) data
 - b) Accuracy assessment LULC 2010 and 2014 map was performed by FAO, JICA-CAMREDD, MRV/FRL –TT (Congalton & Green 1999, 2009) with the 22classes

REDD+ Result

- LANDSAT 8, 22 Classes
- FA, GDANCP, JICA, UN-REDD and FCPF II
- Principal components analysis (PCA)
- Produced land cover/use maps for the years 2016 and 2018 consistent with 2006, 2010, 2014 data.

Emission Factor

- In Cambodia's FRL submission country specific **Emission Factors (EF's)** were used in combination with default values and data obtained from literature review
- Based on a review of data collected from **inventory data of 1755 plots** from mostly project sites of different organizations, obtained for the development of Cambodia's National Forest Inventory sampling design proposal (FAO 2014), a first attempt was made to develop country specific emission factors.
- Sola et al. (2014) identified an initial set of country specific **EFs for Evergreen, Semi-evergreen and Deciduous forest**, and made important recommendations for improvements (UN-REDD, 2014).



- Both for the FRL and for Results reporting these EFs can be used

REDD+ Results considerations

- Submitting result comparing the FRL would be relatively straightforward with the updated map data (2016, 2018), however:
- When planning to apply for Result Based Payments under the GCF RBP Pilot programme REDD+ Technical Annexes submitted for assessment **from 2019 onwards shall present information on aggregate uncertainties. If not, countries will fail the pilot programme scorecard.**
- Estimating aggregate uncertainties was not an UNFCCC requirement for FREL/ FRL, and the pilot programme conditions were not known at the time of the FRL submission. Cambodia's FRL submission did not include information on aggregate uncertainties
- Aggregated uncertainties are derived combining activity data and emission factor uncertainties. Here at tier 1 level according to the IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (IPCC, 2006).

EQUATION 3.1

COMBINING UNCERTAINTIES – APPROACH 1 – MULTIPLICATION

$$U_{total} = \sqrt{U_1^2 + U_2^2 + \dots + U_n^2}$$

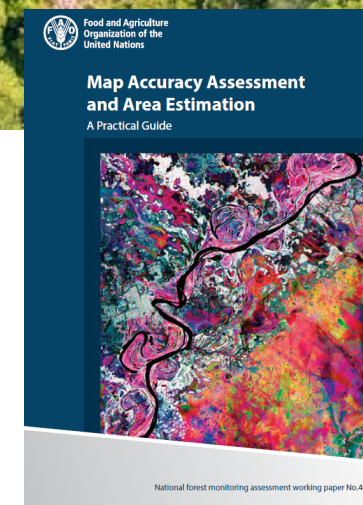
EQUATION 3.2

COMBINING UNCERTAINTIES – APPROACH 1 – ADDITION AND SUBTRACTION

$$U_{total} = \frac{\sqrt{(U_1 \cdot x_1)^2 + (U_2 \cdot x_2)^2 + \dots + (U_n \cdot x_n)^2}}{|x_1 + x_2 + \dots + x_n|}$$

Activity Data (REDD+ Results considerations)

- To derive uncertainties of Activity data (AD) a **Stratified area estimate approach** can be followed, the methodology is described in “A practical Guide: Map Accuracy and Area Estimation” developed by FAO
- The SAE approach results in the following deforestation estimates:



Annual deforestation estimates (ha/yr)			
Period (year to year)	Cambodia map (pixel count)	Stratified area estimate (ha/year)	Confidence interval (%) around SAE
06-10	132,746	147,167	17%
10-14	579,289	312,234	10%
FRL (average 06-14)	356,017	229,701	
14-16	218,825	273,762	17%
16-18	141,001	210,670	20%

Activity Data (REDD+ Results considerations)

- The method consistent with Cambodia's technically assessed FRL suggests Cambodia to have a reduction of deforestation as large as 176,104 ha per year over the results reporting period (2014-2018).
- However, stratified area estimates show deforestation had increased by 44,061 ha/yr during 2014-2016, while deforestation reduced for the subsequent period 2016-2018 with 19,031 ha/yr compared to the 2006-2014 average (the reference period of the technically assessed FRL).

Annual change in deforestation (ha/yr)		
Period (year to year)	Cambodia map (pixel count)	Stratified area estimate (ha/year)
14-16	-137,192	44,061
16-18	-215,016	-19,031
Average 14-18	-176,104	12,515

negative= reduction in deforestation, positive= increase in deforestation

Emission Factor

- The EFs used for the BUR technical annex would be the same as in Forest Reference Level. (Below presented AGB values and uncertainties around Efs).

Forest type	AGB ton ha-1	C ton ha-1	CO2 ton ha-1	Reference used	CI	CI reference
Evergreen forest	163	76.61	280.90	UN-REDD (2014)	7%	UN-REDD (2014)
Semi-evergreen	243	114.21	418.78	UN-REDD (2014)	21%	UN-REDD (2014)
Deciduous	85	39.95	146.48	UN-REDD (2014)	14%	UN-REDD (2014)
Forest regrowth	75	35.25	129.25	CFI (2008) in Sar 2010	30%	IPCC 2006 (Vol 4, Chapter 4, Section 4.2)
Flooded	70	32.9	120.63	MoE (2003)(IPPC 1997)	30%	IPCC 2006 (Vol 4, Chapter 4, Section 4.2)
Plantation	100	47	172.33	MoE (2003)	30%	IPCC 2006 (Vol 4, Chapter 4, Section 4.2)
Pine plantation	100	47	172.33	MoE (2003)	30%	IPCC 2006 (Vol 4, Chapter 4, Section 4.2)
Mangrove	150	70.5	258.51	MoE (2003)	30%	IPCC 2006 (Vol 4, Chapter 4, Section 4.2)
Rear Mangrove	165	77.56	284.35	Tran (2015)	30%	IPCC 2006 (Vol 4, Chapter 4, Section 4.2)
Bamboo	0	0	0			

- However to match the stratified area estimates also a **single EF** could be derived (**137 t/ha +/- 7%**) to pair with the NF, FN, NN, FF data.

REDD+ Results

- The combined Stratified area Estimate and single EF result in the following Annual Emissions estimates (tCO₂/yr) with confidence intervals:

Annual Emissions (tCO ₂ /yr)			
negative= reduction in deforestation, positive= increase in deforestation			
	Cambodia map (pixel count)	Stratified area estimate (SAE)	Confidence intervals(%)
14-16	-35,245,953	9,043,800	9.58
16-18	-46,337,177	-4,811,773	9.69

National Forest Monitoring System

Phase 1
2011-2015

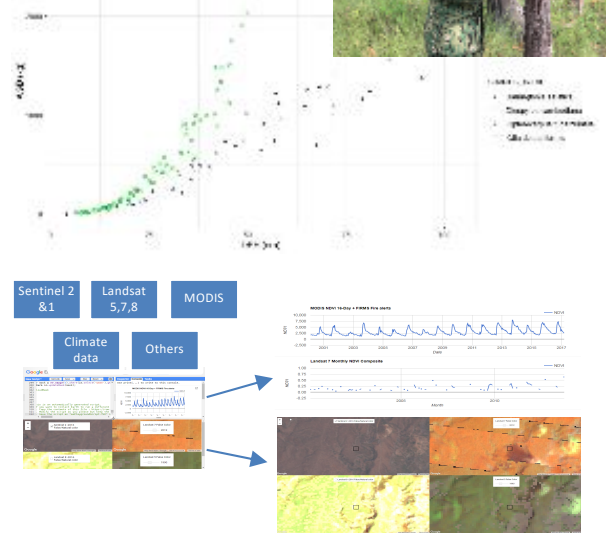
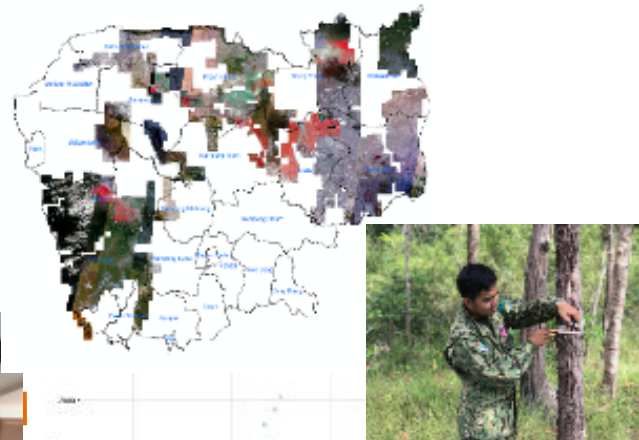
Phase 2
2016-2020

Phase 3
beyond 2020

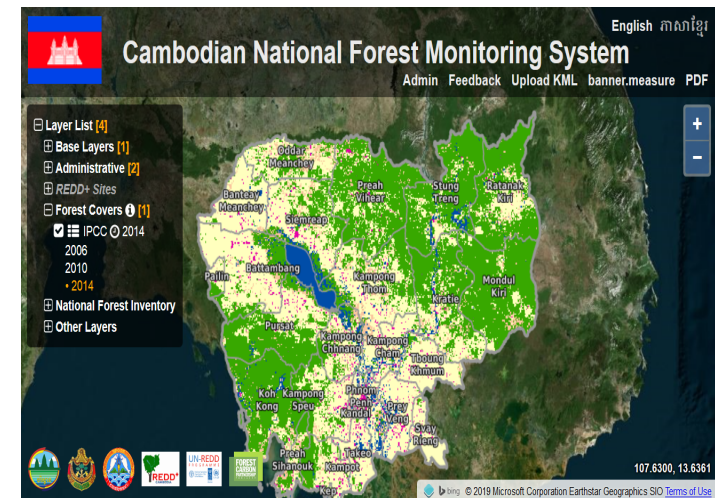
- ✓ aimed at designing the NFMS and building technical and institutional capacity for major activities



- ✓ aims at testing the methodologies designed in phase 1



- ✓ is the full operational stage.



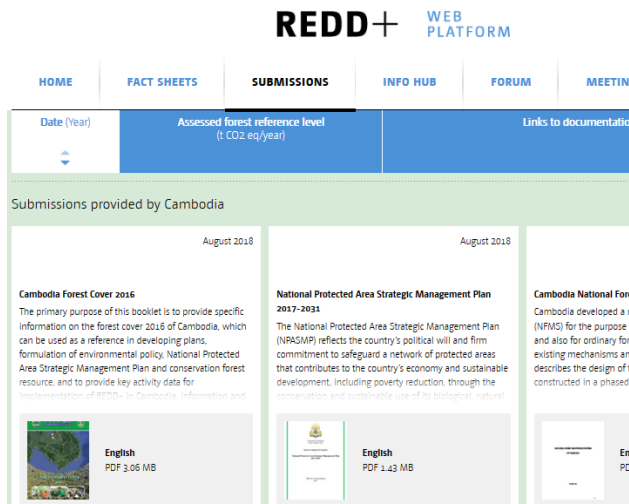
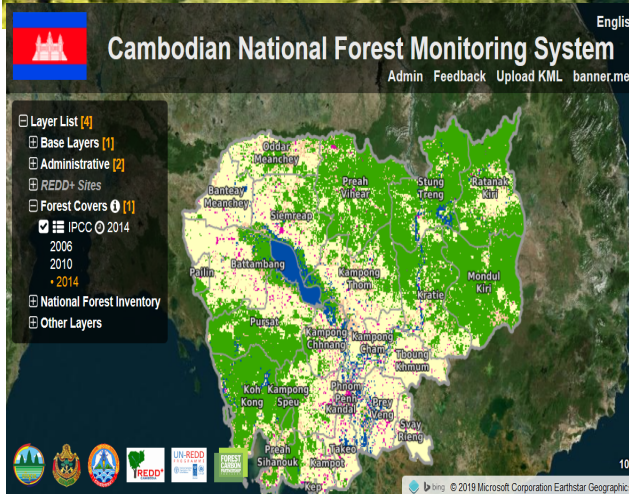


Plans for future NFMS improvements

NFMS improvements foreseen include:

- *Improvement in the Capacities of Monitoring:* such as Near real-time monitoring; using handheld devices for case tracking and to provide feedback information to responsible central government agencies (options community, government use); use of drones of monitoring of land encroachment as well as improvement of AD; monitoring of drivers of deforestation
- *Improved capacities to measure Forest degradation and enhancement:* Such as detection of road disturbance and other disturbances using various tools; classifying different biomass stocks of forests
- *Implementation of Cambodia's first National Forest Inventory:* including with help of mobile handheld devices. Allowing improvement of Emission Factors, and coverage of AGB, BGB, Litre, Deadwood and SOM Carbon Pools
- Development of a nested system and capacity to tracking REDD+ implementation and measures; including implementation arrangement

Necessary information that allows for the reconstruction of the result



TECHNICAL ANNEX PURSUANT TO DECISION 14/CP.19

Progress made [and results achieved] by Cambodia on Reducing Emissions from Deforestation, Forest Degradation and through Enhancements of Forest Carbon Stocks

1 Introduction

This Technical Annex (TA) has been prepared in support of Cambodia's first Biennial Update Report (BUR) and Cambodia's upcoming National Communication (NC). The principal objective of the Technical Annex is to report on progress made [and results achieved] by Cambodia on Reducing Emissions from Deforestation, Forest Degradation and through Enhancements of Forest Carbon Stocks over 2015 to 2018 as Cambodia is transitioning from a REDD+ readiness phase to REDD+ demonstration and full implementation. Key objectives of the TA are also to make information available for public, scientific use and other purposes to contribute to our understanding and to improved natural resource use in Cambodia.

In terms of vision for the forest sector the Royal Government of Cambodia (RGC) adopted a long term vision (See [Cambodia Nor. A 1211](#)) in 2017 with the aim to reduce greenhouse gas emissions from forestry sector to net zero percent before 2040. This aim is consistent with article 5 of the Paris Agreement (which aims to achieve net zero emissions by 2050). The RGC aims to achieve this long term vision by implementing three strategic missions:

1. Achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gas emissions from the forestry sector.
2. Improve livelihood opportunities of local communities to reduce their dependence on forest products.
3. Strengthen the production of timber and fuel wood from plantations and protect natural forests.

The TA includes an additional section with results achieved on Reducing Emissions from Deforestation over 2017 to 2018 including aggregated uncertainties around the results achieved (in line with the GCF requirement to provide information on aggregate uncertainties², taking into account national capabilities and circumstances.) In addition, as part of the improvements mentioned on the FRL submission, the RGC has worked on including information on accuracy assessment of land use change data for periods of 2006 to 2010 and 2010 to 2014. Moreover, Cambodia is moving forward on estimating aggregate uncertainties consistent with IPCC's "methods to combine uncertainties"³. These results will be used as part of the requirements when applying for Results-Based Payments (RBP) under the GCF RBP Pilot programme. An additional section is included to present the technical advancements made by the RGC and as a GCF scorecard (Section 3B: REDD+ plus Results reporting), concerning uncertainties in 2019 commitment to the 2009 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 3.

Forest biomass in Cambodia: from field plots to national estimates

N-REDD PROGRAMME
Cambodia
December 2014
Phnom Penh, Cambodia



Report of TA on Cambodia's FRL Published April 20, 2018



<https://redd.unfccc.int/submissions.html?country=khm>

<http://cambodia-nfms.org>

[NFMS Database](#)

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Thank You!

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