カンボジア王国

農林水産省森林局

カンボジア国
REDD+戦略政策実施支援ﾌﾟﾛｼﾞｪｸﾄ
業務完了報告書
（和文要約）

平成 29 年 11 月
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独立行政法人
国際協力機構（JICA）

アジア航測株式会社

環境
JR
17-127

は じ め に

本報告書は、2011 年 11 月から 2017 年 11 月までの 6 年間に亘り実施した技術協力プロジェクト『カンボジア国 REDD+戦略政策実施支援プロジェクト』の活動報告である。

本業務の実施に当たっては、独立行政法人 国際協力機構本部および同カンボジア事務所の関係各位、同プロジェクトのための長期専門家、カンボジア政府農林水産省森林局、同水産局、環境省自然保全保護総局の職員各位、ならびに FAO に代表されるカンボジア国の REDD+を支援する関係機関（ドナー、国際機関、NGO 等）の関係各位から多大なご指導・ご協力を賜った。ここに深く謝意を表する次第である。

平成 29 年 11 月

アジア航測株式会社
小野 茂

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交換レート
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略語一覧

略　語	正 式 名 称/説明
AD	Activity Data (活動度データ)
AFOLU	Agriculture, Forestry, and Other Land Use（農業、林業およびその他の土地利用）
AGB	Aboveground Biomass（地上部バイオマス）
AIT	Asian Institute of Technology, Thailand（アジア工科大学）
ALOS	Advanced Land Observing Satellite（陸域観測技術衛星だいち）
A/R CDM	Afforestation and Reforestation under Clean Development Mechanism（吸収源 CDM）
AVNIR-2	Advanced Visible and Near Infrared Radiometer-2（高性能可視近赤外放射計 2）
BEF	Biomass Expansion Factor（バイオマス拡大係数）
BGB	Belowground Biomass（地下部バイオマス）
BUR	Biennial Update Report（隔年更新報告書）
C/P	Counter Part（カウンターパート）
C&I	Criteria and Indicators（基準と指標）
CAM-REDD	Project for Facilitating the Implementation of REDD+ Strategy and Policy for Cambodia（カンボジア国 REDD+戦略政策実施支援プロジェクト）
CCBA	Climate, Community and Biodiversity Alliance（気候・地域社会・生物多様性プロジェクト設計スタンダード）
CCCSP	Cambodia Climate Change Strategic Plan（カンボジア気候変動戦略計画）
CG	Consultation Group（コンサルテーショングループ）
CH_4	Methane（メタン）
CO_2	Carbon Dioxide（二酸化炭素）
COP	The Conference of the Parties to the UNFCCC（気候変動枠組条約締約国会議）
d.m.	dry matter（乾燥済み植物材料）
DANIDA	Danish International Development Agency（デンマーク国際開発庁）
DBH	Diameter at Breast Height（胸高直径）
DF	Deciduous Forest（落葉樹林）
DW	Dead Wood（枯死木）

EF	Evergreen Forest（常緑樹林）
EF	Emission Factor（排出係数）
ELC	Economic Land Concession（経済的土地利用権）
ETM+	Enhanced Thematic Mapper Plus（LANDSAT 7 号衛星に搭載されているセンサー）
FA	Forestry Administration of Cambodia（カンボジア国森林局）
FACCC	Forestry Administration Climate Change Committee（森林局気候変動委員会）
FAO	Food and Agriculture Organization（国連食糧農業機関）
FCMP	Forest Cover Monitoring Project (MRC/GTZ)
FCPF	Forest Carbon Partnership Facility（森林炭素パートナーシップ基金）
FCS	Forest Carbon Stocks（森林炭素蓄積量）
FFPRI	Forestry and Forest Products Research Institute (of Japan)（国立研究開発法人　森林研究・整備機構）
FiA	Fisheries Administration of Cambodia（カンボジア国水産局）
FLEGT	Forest Law Enforcement, Governance and Trade（森林法施行ガバナンス貿易）
FREL	Forest Reference Emission Level（森林参照排出レベル）
FRL	Forest Reverence Level（森林参照レベル）
GCF	Green Climate Fund（緑の気候基金）
GDANCP	General Directorate of Administration for Nature Conservation and Protection（自然保全・保護総局）
GHG	Greenhouse Gas（温室効果ガス）
GIS	Geographic Information System（地理情報システム）
GMS	Greater Mekong Sub-region（大メコン圏）
GNSS	Global Navigation Satellite System（衛星航法システム）
GPG-LULUCF	Good Practice Guidance for Land Use, Land-Use Change and Forestry（土地利用、土地利用変化および林業に関する良好手法指針）
GPS	Global Positioning System（全地球測位システム）
GTZ	Deutsche Gesellschaft fur Technische Zusammenarbeit（German Agency for Technical Cooperation ドイツ技術協力公社）
ha	Hectare (ヘクタール)
HD	High Deforestation（激しい森林減少）
HF	High Forest Cover（高い森林被覆率）
IGES	The Institute for Global Environmental Strategies (of Japan)（財団法人地球環境戦略研究機関）

INDC	Intended Nationally Determined Contribution (各国が自主的に決定する約束草案)
INPE	Instituto Nacional de Pesquisas Espaciais（The National Institute for Space Research (of Brazil) ブラジル国立宇宙研究所）
IPCC	Intergovernmental Panel on Climate Change Change（気候変動に関する政府間パネル）
IT	Information Technology（情報技術）
ITTO	International Tropical Timber Organization（国際熱帯木材機関）
JAXA	Japan Aerospace Exploration Agency（宇宙航空研究開発機構）
JCC	Joint Coordinating Committee（共同調整委員会）
JCM	Joint Crediting Mechanism （二国間クレジット制度）
JICA	Japan International Cooperation Agency（独立行政法人 国際協力機構）
LEAF	Lowering Emissions in Asia's Forests（米国が実施しているプロジェクト名）
LD	Low Deforestation（少ない森林減少）
LF	Low Forest Cover （低い森林被覆率）
LULUCF	Land Use, Land Use Change and Forestry（土地利用、土地利用変化および林業）
MAFF	Ministry of Agriculture, Forestry and Fisheries（農林水産省）
MMU	Minimum Mapping Unit（最小図化単位）
MoE	Ministry of Environment (of Cambodia)（カンボジア国環境省）
MRC	Mekong River Commission（メコン川委員会）
MRV	Measurement, Reporting and Verification（測定・報告・検証）
NC	National Communications（国別報告書）
NCCC	National Climate Change Committee（国家気候変動委員会）
NCSD	National Council for Sustainable Development（持続的開発に係る国家評議会）
NESAP	National Environment Strategy and Action Plan（国家環境戦略と活動計画）
N_2O	Nitrous Oxide（亜酸化窒素）
NF	Non Forest（非森林）
NFI	National Forest Inventory（国家森林インベントリー）
NFMA	National Forest Monitoring and Assessment（国家森林モニタリング・評価）
NFMS	National Forest Monitoring System（国家森林モニタリングシステム）
NFP	National Forest Programme（国家森林計画）

NGO	Non-Governmental Organizations（非政府組織）
NPASMF	National Protected Area Strategic System Management Framework（国家保護区の戦略的管理の枠組み）
NPASMP	National Protected Areas Strategic Management Plan（国家保護区戦略管理計画）
NRS	National REDD+ Strategy（国家 REDD+戦略）
NSDP	National Strategic Development Plan（国家戦略開発計画）
OF	Other Forest（その他の森林）
OJT	On-the-Job Training（実施訓練）
PALSAR	Phased Array L Band Synthetic Apperture Radar（フェーズドアレイ方式 L バンド合成開口レーダ）
PCA	Principal Component Analysis（主成分分析）
PDM	Project Design Matrix（プロジェクト・デザイン・マトリクス）
PSP	Permanent Sample Plot（固定標本調査地）
QA/QC	Quality Assurance / Quality Control（品質保証/品質管理）
R/D	Record of Discussion（会議議事録）
REDD	Reducing Emissions from Deforestation and Forest Degradation in developing countries（発展途上国における森林減少・劣化に由来する温室効果ガスの排出削減）
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
REL	Reference Emission Level（参照排出レベル）
RL	Reference Level（参照レベル）
R-PP	Readiness Preparation Proposal（REDDD＋準備フェーズの活動プロポーザル）
RS	Remote Sensing（リモートセンシング）
RTS	REDD+ Task Force Secretariat（REDD+タスクフォース事務局）
SE	Semi-evergreen Forest（半常緑林）
SEPAL	System for Earth Observation Data Access, Processing and Analysis for Land Monitoring（土地モニタリングのための地球観測データへのアクセス、処理そして解析のためのシステム）
SFMP	Strategic Forest Management Plan（戦略的森林管理計画）
SIS	Safeguard Information System（セーフガード情報システム）
SLC	Social Land Concession（社会的土地利用権）

SPFF	The Strategic Planning Framework for Fisheries: 2010-2019 （水産部門の戦略的計画策定枠組み）
SOM	Soil Organic Matter（土壌有機物）
TA	Technical Assistant（技術補佐）
TCP	Technical Cooperation Programme (of FAO)（FAO の技術協力プログラム）
TM	Thematic Mapper (Landsat satellite)（米国 LANDSAT プログラムにおける地球観測センサーの一つ）
TOR	Terms of Reference（委託事項あるいは作業要綱）
TWG	Technical Working Group（技術作業グループ）
UNDP	United Nations Development Programme（国際連合開発計画）
UNEP	United Nations Environmental Programme（国際連合環境計画）
UN-REDD	United Nations REDD Programme（国際連合 REDD プログラム）
USAID	United States Agency for International Development（アメリカ合衆国国際開発庁）
VCS	Verified Carbon Standard（気候変動対策活動から得られる排出削減量・吸収量を認証し、クレジットとして発行させる認証スキーム）
VCU	Verified Carbon Unit（認証炭素単位）
WB	World Bank（世界銀行）
WBS	Work Breakdown Structure（作業分解図）
WCS	Wildlife Conservation Society（米国に本拠を置く環境 NGO）

カンボジア位置図

English	和名	英名	和名
Banteay Meanchey Province	バンテイメンチェイ州	Oddar Meanchey Province	オッドミアンチェイ州
Battambang Province	バタンバン州	Pailin Province (municipality)	パイリン州
Kampong Cham Province	コンポンチャム州	Phnom Penh Municipality	プノンペン特別市
Kampong Chhnang Province	コンポンチュナン州	Preah Sihanouk Province (municipality)	シアヌークビル州（特別市）
Kampong Speu Province	コンポンスプー州	Preah Vihear Province	プレアビヒア州
Kampong Thom Province	コンポントム州	Pursat Province	プルサト州
Kampot Province	カンポット州	Prey Veng Province	プレイベン州
Kandal Province	カンダール州	Ratanakiri Province	ラタナキリ州
Koh Kong Province	コッコン州	Siem Reap Province	シェムリアップ州
Kep Province (municipality)	ケップ州（特別市）	Stung Treng Province	ストゥントレン州
Kratie Province	クラチエ州	Svay Rieng Province	スヴァイリエン州
Mondulkiri Province	モンドルキリ州	Takeo Province	タケオ州

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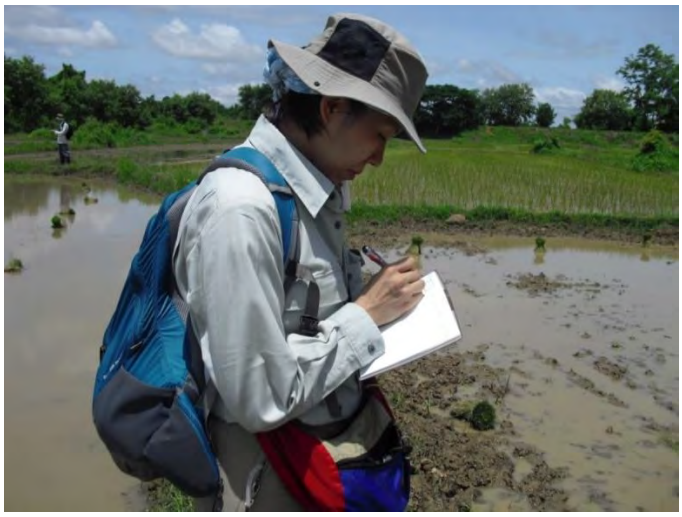
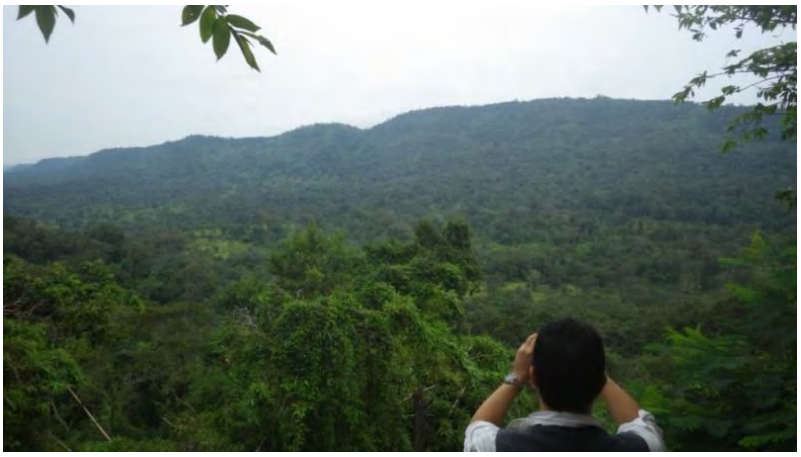
写真-12 土地利用被覆状況調査（森林総研の現地調査に同行） 2014 年 7 月 クラティエ地区	

写真-13 土地利用被覆現地調査 2014 年 10 月 プレアシアヌーク州	
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第1章　プロジェクトの概要

1.1　　カンボジア国の概要（英文報告書　1.1）

カンボジア国はメコン川下流域に位置し、ベトナム、タイ、ラオスの 3 国と国境を接している。国土、人口、経済状況は以下のとおりである。

- 国土面積: 181,035 km^2
- 森林面積[1]：　2016 年時点で約 875 万 ha
- 気候: 熱帯モンスーン地域（雨季と乾季の２時季）
- 人口　：2016 年で 15,762,370 人　(出典：世界銀行)[2]
- 経済成長率：　GDP で　6.9%　　2016 時点（出典:　世界銀行）

カンボジアの“Cambodia Industrial Development Policy 2015-2025” (March 2015)によると、各セクターの GDP への貢献度は下表のとおりであり、農業分野の比率が下がる一方、工業セクターの開発が奨励されている。この工業セクターにはゴムの生産も含まれている。

表 1　GDP への各セクターの貢献度

セクター	1962	1998	2008	2013	2015	2020	2025
農業	49%	44.5%	32.8%	31.6%	29.0%	25%	23%
工業	19%	16.7%	22.4%	24.1%	26.2%	28%	30%
-工業の内の製造業	-	12.7%	15.3%	15.5%	16.0%	18%	20%
サービス産業	32%	34.8%	38.8%	38.5%	39.4%	40%	40%
製造物への税金から補助金を除いた率	0%	4%	6%	5.8%	5.4%	7%	7%

(出典: “Cambodia Industrial Development Policy 2015-2025”, March 2015)

1.2　　プロジェクトの背景（英文報告書　1.2）

カンボジア国は 2016 年の土地利用被覆図によると国土面積 181,035 km^{2}のおおよそ 48%[3]が森林である。1995 年以降の森林率がカンボジア森林局作成の資料に掲載されているが、それによると、1995 年以来森林率は確実に減り続けており、2002 年から 2006 年では年平均 0.5%の割合での森林減少が認められる。

[1]国家森林計画上での森林定義に基づく数字であり、油ヤシとゴムのプランテーションが森林に含まれている。

[2] http://databank.worldbank.org/data/reports.aspx?source=2&country=KHM

[3] 国家森林計画上での森林定義に基づく数字であり、油ヤシとゴムのプランテーションが森林に含まれている。

そこで、「カ」国政府は2010年に「国家森林計画（National Forest Programme: NFP）」（2011～2030） を策定し森林管理の方向性を示した。この計画では森林に係る活動を①林地境界分類・登記、②森林資源管理と保全、③法執行、④村落林業、⑤能力強化と研究開発、⑥持続的財源確保に分けて記述しており、2015 年の森林率を 60%に戻すという目標が設定された。

一方、カンボジア政府は、2010 年 9 月に REDD+の準備プロセスの計画書である「国家 REDD＋ロードマップ」を作成し、気候変動枠組条約における取り組みとなる REDD+へ参画し、REDD+準備段階における政府の実施能力強化のため、日本政府に支援を要請したものである。

日本政府はこの要請に応え、JICA が「カンボジア国 REDD+戦略政策実施支援プロジェクト」、通称「CAM-REDD」の実施を決定した。

1.3 カンボジアの森林管理（英文報告書 1.3）

1.3.1 関係法規、戦略、計画等(英文報告書 1.3.1)

カンボジアには森林と自然資源の管理に関係する法規、計画、戦略が以下のとおり複数存在している。

法規

- 1993 Royal Decree on Creation and Determination of Nature Reserves
- Environmental Protection and Natural Resources Management Law 1996
- Land Law 2001
- Forestry Law 2002
- Fisheries Law 2006
- Protected Areas Law 2008
- 2009 Sub-decree #83 on Registration of Land of Indigenous Communities

計画および戦略

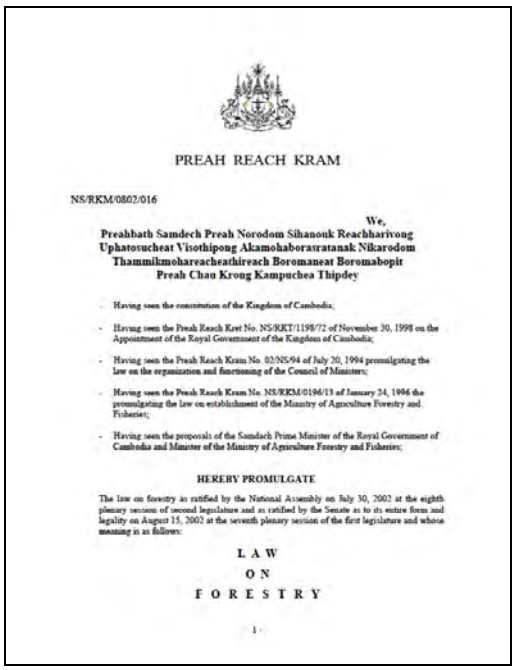
- First National Communication 2002
- National Forest Programme 2009-2029
- Strategic Planning Framework for Fisheries 2010-2019
- Rectangular Strategy Phase III 2013-2018
- National Strategy and Action Plan 2014-2016 Mangroves for the Future (2013)
- National Policy on Green Growth and Green Growth Strategic Plan 2013-2030
- Gender and Climate Change Action Plan 2014-2018
- National Strategic Development Plan 2014-2018
- Cambodia Climate Change Strategic Plan 2014-2023
- Second National Communication 2015

- National Environment Strategy and Action Plan (NESAP) covering 2015 - 2023
- National Protected Areas Strategic Management Plan 2016-2030
- National Biodiversity Strategy and Action Plan 2016-2020
- National Environmental Code (Draft)

主要な法規、計画、戦略の要旨は以下のとおりである。

① **森林法** Law on Forestry

2002 年に制定された森林法は、森林の管理、伐採、利用、開発そして保護の枠組みを規定するものである。森林法では、他の法律によってその管理が規定されている浸水林以外の森林は農林水産省の管轄下であると規定している。さらに、保護区の管理については環境省に委託することも規定されている。



PREAH REACH KRAM

NS/RKM/0802/016

We,
Preahbath Samdech Preah Norodom Sihanouk Reachharivong
Uphatosucheat Visothipong Akamohaborasratanak Nikarodom
Thammikmohareacheathireach Boromaneat Boromabopit
Preah Chau Krong Kampuchea Thipdey

- Having seen the constitution of the Kingdom of Cambodia;
- Having seen the Preah Reach Kret No. NS/RKT/1198/72 of November 30, 1998 on the Appointment of the Royal Government of the Kingdom of Cambodia;
- Having seen the Preah Reach Kram No. 02/NS/94 of July 20, 1994 promulgating the law on the organization and functioning of the Council of Ministers;
- Having seen the Preah Reach Kram No. NS/RKM/0196/13 of January 24, 1996 the promulgating the law on establishment of the Ministry of Agriculture Forestry and Fisheries;
- Having seen the proposals of the Samdach Prime Minister of the Royal Government of Cambodia and Minister of the Ministry of Agriculture Forestry and Fisheries;

HERERY PROMULGATE

The law on forestry as ratified by the National Assembly on July 30, 2002 at the eighth plenary session of second legislature and as ratified by the Senate as to its entire form and legality on August 15, 2002 at the seventh plenary session of the first legislature and whose meaning is as follows:

LAW
ON
FORESTRY

1

図 1 森林法の表紙

② **国家森林計画** National Forest Programme（NFP）

2010 年 10 月に閣僚会議で承認された国家森林計画 (NFP) は 2010 年から 2029 年の 20 年間の森林セクターの計画であり、6 つのプログラムから構成されている。すなわち、森林の境界確定：分類と登録、森林資源と生物多様性の保護と開発、森林法の的確な執行と統治、村落林業、能力と研究の開発、そして持続的な森林財務である。

NFP では森林率を 60%まで増やすことが数値目標となっている。NFP に掲げられているビジョン、ミッションと戦略的目的は以下のとおりである。

図 2　国家森林計画の表紙

ビジョン

森林資源の生態的、社会経済的、文化的そして環境的に健全な管理と開発は、公共福祉の主要な柱のひとつである。

ミッション

カンボジアの森林の持続的な管理と開発を、貧困軽減、生計の向上、経済発展、そして生物多様性とカンボジアの文化遺産の保護も含めた環境保護に寄与できるよう促進する。

戦略的目的

1. 森林の貧困削減、生計向上そして公平な経済発展への持続的貢献の最大限化。
2. 気候変動に対応し、森林に基づいた生計への影響の軽減。
3. セクター、管轄権や地方政府の境界を跨いだマクロな土地利用計画。
4. 全てのレベルにおける森林統治、法律そしてその執行。
5. 係争を管理するシステムの開発。
6. NFP を持続的に実施することを可能にする、関心、組織の能力そして教育の質の向上。
7. 環境保護と森林資源の保全の確実な実施。
8. 変化する環境に対応できる近代的で持続的な管理モデルの適用。
9. 持続的財政システムの開発。

上記の戦略 9 では以下のように炭素市場からの利益も自律的財政の一部とみなされている。

"The NFP outlines methods of self-financing for the forestry sector, based initially on donor and government support whilst gradually introducing cautious low impact logging, certification and exports, and benefits from carbon markets."

NFP では 2010 年から 2029 年の間の戦略的指標も設定されているが、その中で REDD+ に関係する指標は以下のとおりである。

- 森林率を 60%まで増やす。[4]
- 準備やメンテナンスコストを引いた後の、炭素固定からの年間平均収入を US$2500 万とする。

[4] NFP では、ゴム、油ヤシプランテーションと多年生作物が森林の定義に含まれている。

- 森林管理の結果を見せるための森林モニタリングと報告システムは毎月更新され公開される。
- 保護林を 300 万 ha にする。
- 200 万 ha の森林を村落林業契約に基づく村落林業（約 1000 件）に提供する。

③　四辺形戦略と国家戦略開発計画
(Rectangular Strategy and National Strategic Development Plan 2014-2018)

四辺形戦略と通称される「成長、雇用、公平そして効率のための四辺形戦略」は、カンボジアの持続的な社会経済開発についての政治的公約の具体的な計画を示すものである。その中で、自然資源の持続的管理は農業セクターの振興という戦略の一部として提示されている。

国家戦略開発計画（National Strategic Development Plan：NSDP ）は、四辺形戦略で定められた戦略を推進するためのものであるる。現在の NSDP は四辺形戦略 Phase III に対応するもので 2014 年から 2018 年の 4 年間をカバーしている。

④　国家環境戦略とアクションプランおよび環境法
(National Environment Strategy and Action Plan と Environmental Code)

国家環境戦略とアクションプラン（NESAP）は、2015 年から 2023 年の間の持続的な自然資源管理、環境保護のための優先的な政治的施策、財務オプションを提示するものであり、開発計画そして投資に際して政府、民間セクター、市民社会、開発機関が環境への配慮を行うためのガイドラインである。

環境基本法は、環境保全、持続的開発、気候変動対策などに強固な法的枠組みを作ることを目的としており、2017 年末までに策定作業が終了する予定である。

⑤　国家保護区戦略的システム管理枠組み(National Protected Area Strategic System Management Framework)

2014 年に制定された国家保護区戦略的システム管理枠組（NPASMF）は、新規保護区や保全地域の設定に際しての障害、現有の保護区に対する様々な圧力、そしてこれら地域の管理を妨げる要因への対策について、長期かつ包括的な指針を与えるものである。（出典：カンボジアの NRS）

この枠組みのミッションの中に、保護区の拡大と生態的コリドーの設置が掲げられておいるが、すでに 5 つの生物多様性コリドーの位置と範囲が提案されている。

⑥　カンボジア気候変更戦略計画(Cambodia Climate Change Strategic Plan 2014-2023)

カンボジアの気候変動戦略計画（CCCSP）は NSDP に合わせて 2013 年 10 月に発表された。

CCCSP は、気候変動への適応、温室効果ガス削減、低炭素開発に関する幅広い気候変動問題に取り組むための戦略を統一することを目的としている。CCCSP は 8 つの戦略目標を掲げており、その内の戦略目標 3 は「重要な生態系（トンレサップ湖、メコン川、沿岸生態系、高地など)、生物多様性、保護区、文化遺産の気候レジリエンスを確保すること」である。この目標を達成するための 4 つの戦略の 1 つとして、「REDD +を含む生態系サービスの支払いを促進すること」が明記されており、REDD +は、気候変動の問題に対処するのに適したツールの 1 つとして認識されている。

1.3.2　　森林管理体制（英文報告書　1.3.2）

JICA 技術支援チームが 2011 年 11 月にカンボジアで業務を開始した時点では、カンボジアの森林管理体制は図 3 に示されているとおり以下の 3 省庁によって管理されていた。

- ☐　農林水産省森林局
- ☐　環境省：保護区管理を担当
- ☐　農林水産省水産局：浸水林とマングローブ地域担当

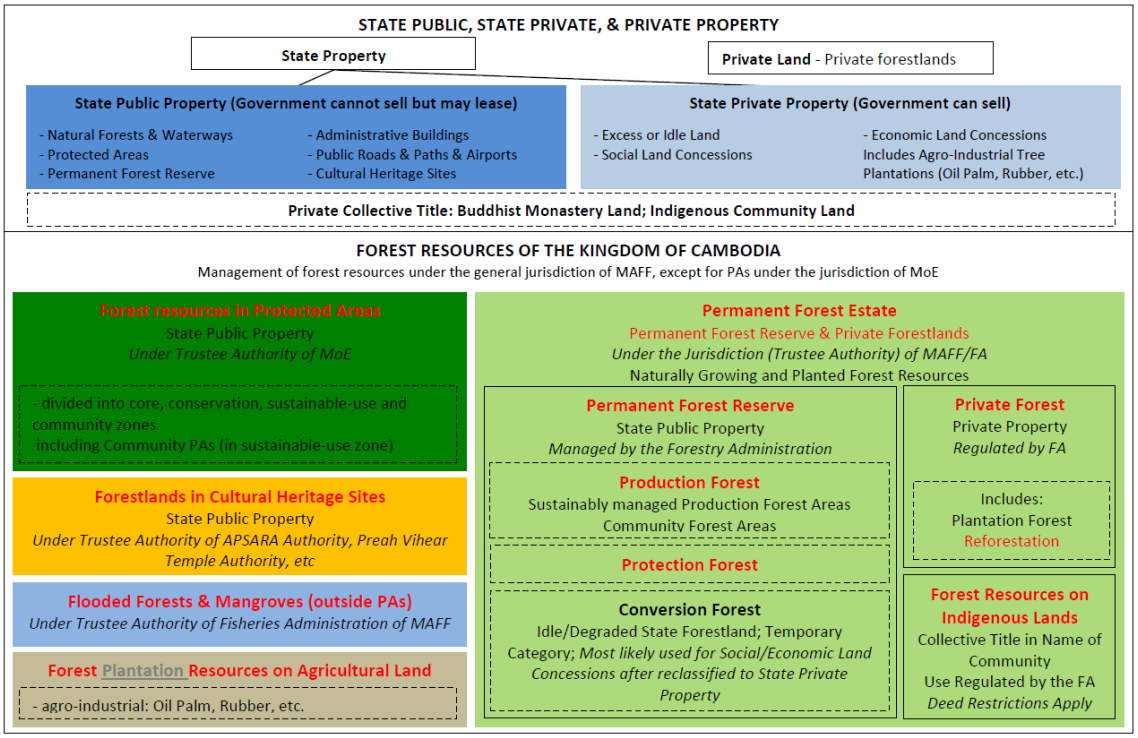


図 3　2016 年の森林・環境管理体制改編以前の森林管理体制
(出典: Cambodia REDD+ Roadmap)

この管理体制は 2016 年に、以下のような 2 種類の政令により大幅に変更され、森林管理の権限が大幅に森林局から環境省に委譲された。

- 政令 No.34 （2016 年 3 月 4 日付）“Reformation the positions and duties of MoE and MAFF regarding management of ELCs and management of PA, and forest and fisheries conservation areas”
  （ELC の管理、及び保護区、森林、水産保全地区の管理に関する環境省と農林水産省の立場と役割の再編に関する政令）
- 政令 No.69 （2016 年 4 月 28 日付）“The Transfer of the Protected Forest, Forest Conservation and Production Forest Areas, and Economic Land Concessions between MAFF and MoE”,
  （農林水産省と環境省の間での、保護林、森林保全および生産林、そして経済的土地利用権地域の移管に関する政令）

2017 年 10 月現在、カンボジアの森林管理体制は以下のとおりである。

- 森林局は、Forest Reserve と Conservation Forest を含む Permanent Forest Estate の管理を担当。
- 水産局は、浸水林とマングローブ地区の管理を担当
- 環境省の自然保全・保護総局（GDANCP)は、Tonle Sap Biosphere Reserve の中核地域と生物多様性保全回廊を含む約 750 万 ha の保護区ネットワークの管理を担当する。

1.3.3 森林被覆（英文報告書 1.3.3）

カンボジアの森林は、土地利用被覆評価の目的のために 11 種類に分類されている。すなわち、Evergreen Forest, Semi-Evergreen Forest, Deciduous Forest, Bamboo, Mangrove, Rear Mangrove, Flooded Forest, Forest Regrowth, Pine Tree, Pine plantation and Tree plantation である。2006 年 2010 年そして 2014 年の森林率は、図 4 に示すとおりである。この図は、森林局が 2011 年 10 月に発行した、“Cambodia Forest Cover 2010”に掲載されているものである。この図での森林定義は NFP での定義と同じで、油ヤシとゴムの植林地並びに多年生作物も森林に含まれている。

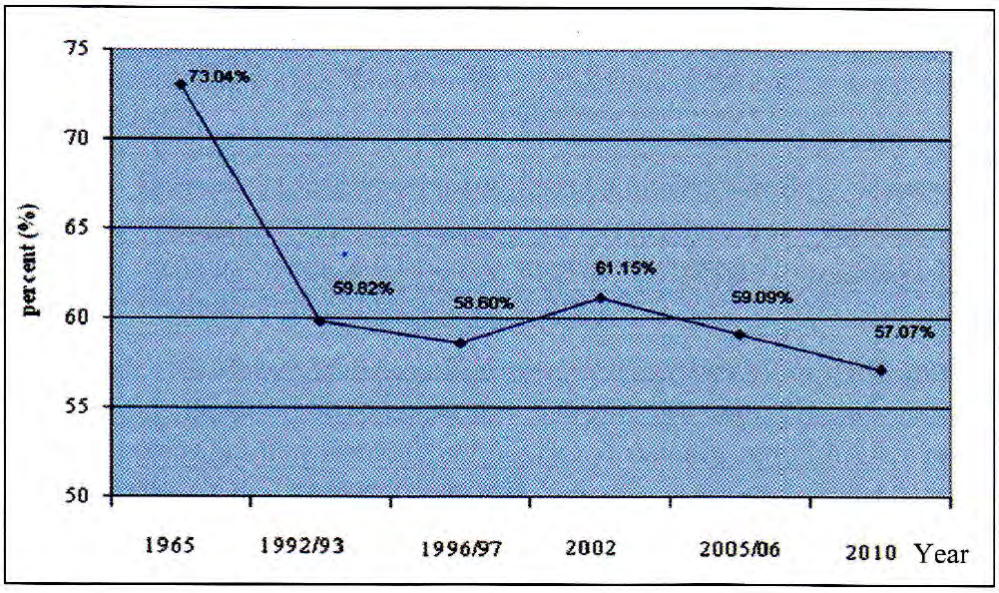


図 4　カンボジアの森林被覆率変化（森林定義は NFP のもの）

この図では、1965 年には 70%以上であった森林率が 2010 年には 57.07%まで減少したことが示されている。ただし 1965 年から 1992/93 の間の森林率の急激な変化は、このグラフの時間軸の目盛が等間隔ではないことによるものである。時間軸の目盛を同じ間隔に加工すると図 5 のようになる。

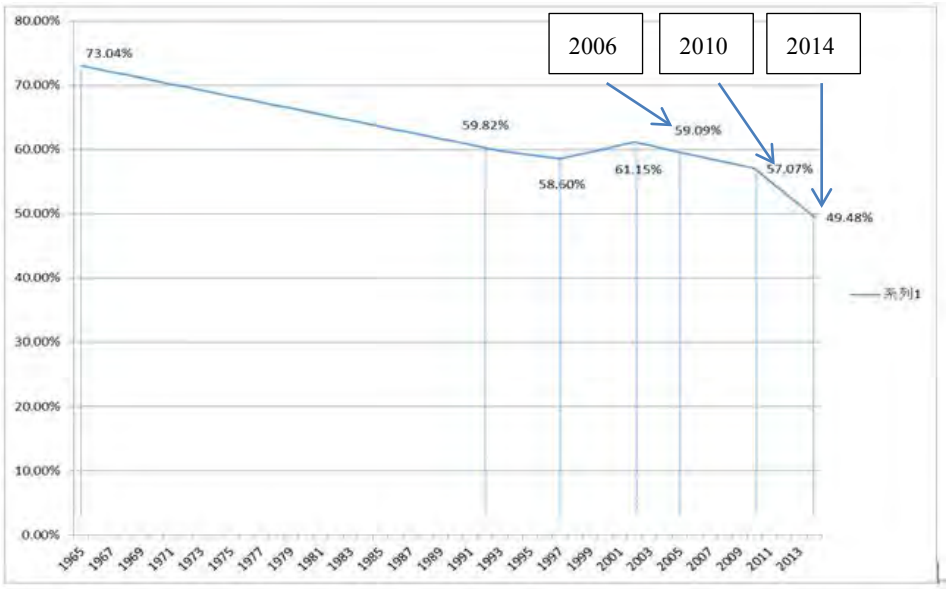


図 5　カンボジアの森林被覆率変化修正版（森林定義は NFP のもの）

表 2　カンボジアの土地被覆クラス別面積（面積単位：ha）

土地被覆分類	2006		2010		2014		2016	
	面積（ha）	割合（%）	Ha	%	Ha	%	Ha	%
Evergreen Forest	3,710,271	20.43%	3,573,925	19.68%	2,973,903	16.38%	2,861,233	15.76%
Semi-evergreen forest	1,453,441	8.00%	1,391,117	7.66%	1,108,320	6.10%	1,071,947	5.90%
Deciduous Forest	4,613,417	25.40%	4,498,397	24.77%	3,480,532	19.17%	3,336,349	18.37%
Flooded Forest	597,355	3.29%	524,005	2.89%	481,078	2.65%	477,813	2.63%
Forest Regrowth	216,123	1.19%	249,341	1.37%	228,560	1.26%	196,842	1.08%
Bamboo	129,837	0.71%	130,930	0.72%	130,678	0.72%	125,398	0.69%
Mangrove	32,060	0.18%	31,443	0.17%	33,002	0.18%	31,226	0.17%
Rear Mangrove	27,519	0.15%	27,371	0.15%	25,906	0.14%	25,906	0.14%
Pine Forest	8,157	0.04%	8,157	0.04%	8,196	0.05%	8,195	0.05%
Pine Plantation	0	0.00%	11	0.00%	3,709	0.02%	3,870	0.02%
Tree Plantation	43,547	0.24%	17,214	0.09%	44,289	0.24%	43,122	0.24%
森林面積	**10,831,727**	**59.64%**	**10,451,911**	**57.55%**	**8,518,173**	**46.90%**	**8,181,901**	**45.05%**
Oil Palm Plantation	35	0.00%	5,055	0.03%	36,311	0.20%	51,276	0.28%
Rubber Plantation	78,148	0.43%	137,307	0.76%	484,316	2.67%	509,224	2.80%
Grassland	600,006	3.30%	473,281	2.61%	351,337	1.93%	341,132	1.88%
Agriculture	1,000,634	5.51%	1,275,444	7.02%	2,787,413	15.35%	3,017,435	16.62%
Paddy Filed	3,668,981	20.20%	3,859,452	21.25%	4,133,474	22.76%	4,221,407	23.24%

Rock	219	0.00%	668	0.00%	2,054	0.01%	1,100	0.01%
Sand	8,304	0.05%	10,459	0.06%	40,581	0.22%	41,245	0.23%
Built up area	37,435	0.21%	43,800	0.24%	328,820	1.81%	352,987	1.94%
Village	248,126	1.37%	296,513	1.63%	42,166	0.23%	42,930	0.24%
Water	438,410	2.41%	458,658	2.53%	813,839	4.48%	783,849	4.32%
Wood shrub	1,248,649	6.88%	1,148,126	6.32%	622,190	3.43%	616,177	3.39%
非森林面積	**7,328,947**	**40.36%**	**7,708,763**	**42.45%**	**9,642,501**	**53.10%**	**9,978,762**	**54.95%**
合計	**18,160,674**	**100.00%**	**18,160,674**	**100.00%**	**18,160,674**	**100.00%**	**18,160,674**	**100.00%**

図 5 によると、1965 年と 1992 年の間の森林減少率は、2002 年と 2010 年の間の減少率と概ね同じことが分かる。なお、1997 年から 2002 年に掛けて森林が増えた理由として、カンボジア政府は、森林図作成手法の改良によるものと説明している。すなわち、紙に印刷した衛星画像を判読する手法から、パソコンのスクリーンに映した画像を判読した結果を、GIS ソフトを用いて地図として描く方法への改良である。

図 4 と図 5 は、共に NFP における森林定義に基づいた森林率を表しているが、カンボジア政府は REDD+で用いる森林定義には、油ヤシとゴム植林そして多年生作物を含まないことを決定した。この定義に基づき、本プロジェクトによる支援で改良されあるいは作成された土地利用被覆図上で計測した森林被覆率をグラフにしたものが図 6 である。

当プロジェクトで作成された 2006 年と 2010 年の地図上では、森林面積がそれぞれ元の地図上での面積より増えているが、これは、新たな技術の導入により、これまで見逃していた小さな森林が捉えられた結果である。

図 6　2006 年から 2016 年の森林率変化（REDD+用森林定義による）

図 6 から計算した年平均の森林減少率は以下のとおりである。

2006－2010:　(59.64% - 57.55%)/4 = 0.52%
2010－2014:　(57.55% - 46.90%)/4 = 2.66%
2014－2016:　(46.90%-45.05%)/2　= 0.92%

この数値からは、2010 年から 2014 年の 4 年間の森林減少率が大きかったことが分かる。2016 年 11 月に UNFCCC に提出され現在 UNFCCC に評価を受けている FRL 書類によると、2006 年から 2014 年の間の炭酸ガスの排出量は 78,953,951 t CO_2.[5] である。

国家 REDD+戦略(NRS)原稿 [6]では、森林減少と劣化の原因として 9 つの原因を挙げている。

- 遠隔地への交通の便の改良、商業伐採、インフラプロジェクトの実施、並びにそうした地域で森林を管理する政府の能力欠如。
- 不確かな土地保有権、土地投機、森林への違法な侵食。
- 1996 年から 2006 年の間の森林への農業の急速な拡大、大規模な農業ビジネスへの経済的土地利用権の付与、そして社会的土地利用権制度による土地保有権の付与。
- 無許可の森林伐採、持続性の無い森林と非木材生産物の収穫。
- 森林と土地利用セクターの、弱体なガバナンス、法執行、そしてモニタリング。
- ゴムや砂糖などの原材料への地域及び世界的な需要の伸び。
- 人口増加と農地の需要増加
- 地方の貧困と代替生活手段が無いこと。
- 他の原因は、森林地域への移住、土地法規の脆弱な執行、環境・社会影響評価の不適切な実施、国の土地の登録および森林境界の欠如など。

NRS では、2014 年までに発生した森林減少の主要原因とその面積についても下表のように分析している。

表 3　森林減少面積と原因

森林減少の原因	減少面積	備考
農業ビジネス開発	2,020 千 ha	1,550 千 ha は農林水産省の決定により土地利用変更が認可された。 470 千 ha は環境省の決定によりと土地利用変更が認可された
社会的土地利用権の付与 貧困家庭、軍人の家庭のためあるいは新たな村を建設するため。	2,450 千 ha	2009-2013
土地を持たない村落に土地所有権利書を発行するための、森林区域の用地変更	1,200 千 ha	2014 年に発生

[5] この通知は 2017 年 5 月 22 日時点のものである。

[6] 本報告書執筆段階では、NRS はカンボジア政府の承認を待っているところである。

1.4　　カンボジアの気候変動への対応（英文報告書　1.4）

カンボジアの四辺形戦略フェーズ III や国家戦略的開発計画では、気候変動への対応が優先課題のひとつとして取り上げられている。

カンボジアは 1995 年 12 月 18 日に UNFCCC を批准し、1996 年 3 月 17 日に正式にそのメンバーとなった。また、カンボジアは京都議定書を 2002 年 8 月 22 日に批准し、2005 年 2 月 16 日に発効となった。気候変動問題を担当する政府の体制と主要な書類は以下のとおりである。

1.4.1　　気候変動対策を担当する国の組織（英文報告書　1.4.1）

2006 年に、カンボジア王国政府は気候変動に関する政策、戦略、法的手段、計画およびプログラムの実施を準備、調整、監視する任務を有する、複数部門および複数分野にまたがる「国家気候変動委員会」（NCCC）を設立した。その後、2015 年 5 月に、NCCC の機能は「国家持続可能な開発評議会」（NCSD）に改編されて引き継がれた。図 7 に示すように、NCSD には REDD+にも関連している 4 つの部門がある。NCSD の気候変動局と共にカンボジア気候変動戦略計画（CCCSP）の作成実務を担当しているのは MoE の GDANCP である。

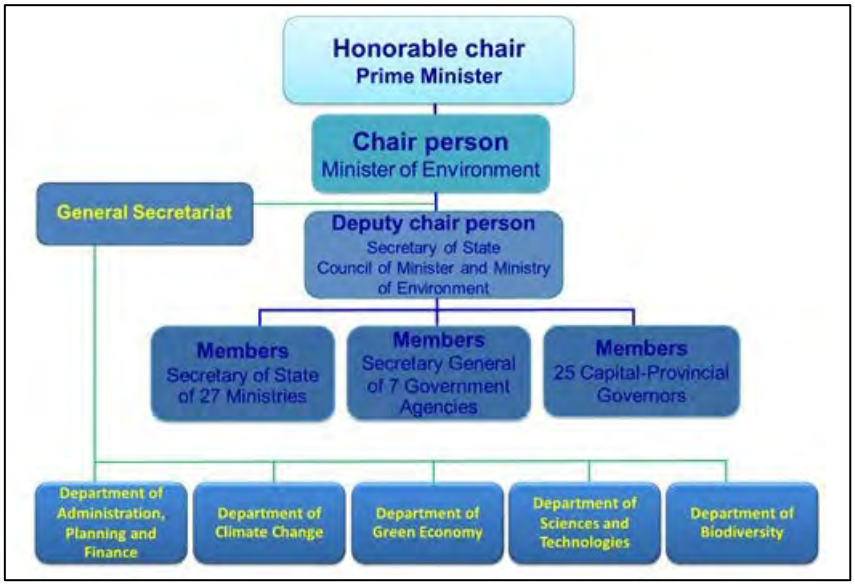


図 7　NCSD の組織図

1.4.2 INDC と国別報告書（National Communication）（英文報告書　1.4.2）

カンボジア政府は、気候変動に関する同国の対応を報告する重要な文書である、国別報告書（National Communication : NC）と Intended National Determined Contribution（INDC）とを UNFCCC に提出してある。最初の国別報告書の提出は 2002 年 10 月、INDC の提出は 2015 年 2 月である。その後、2016 年 1 月に 2 回目の国別報告書が提出されたが、その温室効果ガスインベントリーは 2000 年時点のものであった。現在、第 1 回目の隔年更新報告書（Biennial Update Report）の提出が検討されている。

1.4.3 REDD+ ロードマップ（英文報告書　1.4.3）

2017 年に FAO が発行した“Forest change in the greater Mekong subregion (GMS)”によると、大メコン圏の国の森林減少率は表 4 のとおりである。2015 年のカンボジアの森林率 54%はカンボジア政府が公表している数値より高いため他の国の森林率の信頼性も高くないと判断されるが、この表上ではカンボジアの森林減少率は域内 5 か国中、ミャンマーに次いで高い。

表 4　大メコン圏の国の森林率変化

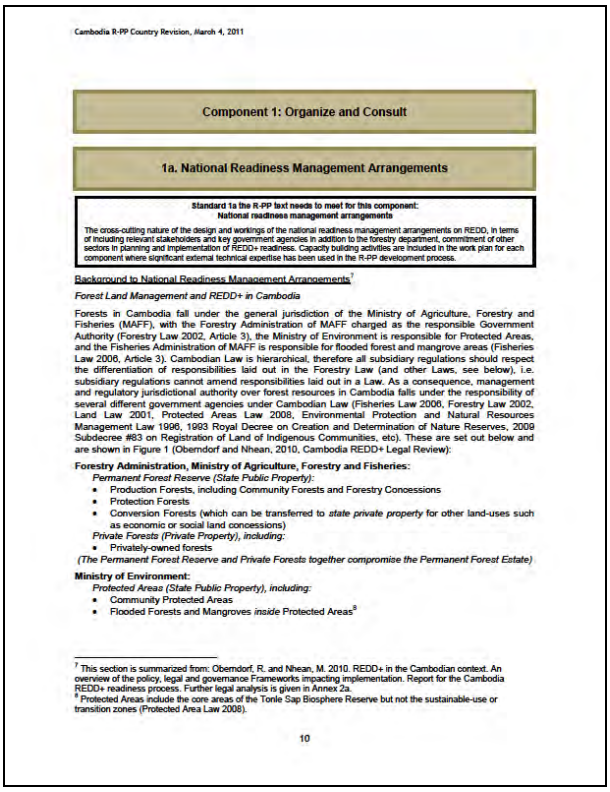
国	2015 年の森林率(%)	森林域の年変化 (%)		
		1990-2000	2000-2010	2010-2015
カンボジア	54	-1.1	-1.3	-1.3
ラオス	81	-0.7	0.8	1.0
ミャンマー	44	-1.2	-0.9	-1.8
タイ	32	2.0	-0.5	0.2
ベトナム	48	2.3	1.9	0.9

カンボジア政府は REDD＋という仕組みが森林減少や劣化を抑制するのに効果的との理解の下、2008 年には最初の REDD+プロジェクトを立ち上げ、2009 年には UN-REDD 計画のパートナーとなった。さらに、2009 年から 2010 年に掛けて REDD+ Readiness Roadmap（図 8）を策定し、2009 年には FCPF に対して Readiness Plan Proposal を提出、2011 年に UN-REDD National Programme に署名した。

ロードマップでは、REDD+ 準備プロセス段階の活動として以下の 6 つが挙げられており、カンボジアはこのロードマップに従って REDD+準備活動を実施してきた。

- 国家 REDD+ 準備プロセスの管理
- コンサルテーション、関係者の関与そして関心を挙げるための計画

- REDD+戦略の開発と選択（土地利用、方針そしてガバナンスの評価を含む）
- REDD+実施の枠組み(利益配分とセーフガードを含む)
- 参照シナリオの開発
- 国としてのモニタリング、報告そして検証（MRV）のためのモニタリングシステムの開発



Cambodia R-PP Country Revision, March 4, 2011

Component 1: Organize and Consult

1a. National Readiness Management Arrangements

Standard 1a the R-PP text needs to meet for this component:
National readiness management arrangements

The cross-cutting nature of the design and workings of the national readiness management arrangements on REDD, in terms of including relevant stakeholders and key government agencies in addition to the forestry department, commitment of other sectors in planning and implementation of REDD+ readiness. Capacity building activities are included in the work plan for each component where significant external technical expertise has been used in the R-PP development process.

Background to National Readiness Management Arrangements[7]

Forest Land Management and REDD+ in Cambodia

Forests in Cambodia fall under the general jurisdiction of the Ministry of Agriculture, Forestry and Fisheries (MAFF), with the Forestry Administration of MAFF charged as the responsible Government Authority (Forestry Law 2002, Article 3), the Ministry of Environment is responsible for Protected Areas, and the Fisheries Administration of MAFF is responsible for flooded forest and mangrove areas (Fisheries Law 2006, Article 3). Cambodian Law is hierarchical, therefore all subsidiary regulations should respect the differentiation of responsibilities laid out in the Forestry Law (and other Laws, see below), i.e. subsidiary regulations cannot amend responsibilities laid out in a Law. As a consequence, management and regulatory jurisdictional authority over forest resources in Cambodia falls under the responsibility of several different government agencies under Cambodian Law (Fisheries Law 2006, Forestry Law 2002, Land Law 2001, Protected Areas Law 2008, Environmental Protection and Natural Resources Management Law 1996, 1993 Royal Decree on Creation and Determination of Nature Reserves, 2009 Subdecree #83 on Registration of Land of Indigenous Communities, etc). These are set out below and are shown in Figure 1 (Oberndorf and Nhean, 2010, Cambodia REDD+ Legal Review):

Forestry Administration, Ministry of Agriculture, Forestry and Fisheries:
Permanent Forest Reserve (State Public Property):
- Production Forests, including Community Forests and Forestry Concessions
- Protection Forests
- Conversion Forests (which can be transferred to *state private property* for other land-uses such as economic or social land concessions)

Private Forests (Private Property), including:
- Privately-owned forests

(The Permanent Forest Reserve and Private Forests together compromise the Permanent Forest Estate)

Ministry of Environment:
Protected Areas (State Public Property), including:
- Community Protected Areas
- Flooded Forests and Mangroves *inside* Protected Areas[8]

[7] This section is summarized from: Oberndorf, R. and Nhean, M. 2010. REDD+ in the Cambodian context. An overview of the policy, legal and governance Frameworks impacting implementation. Report for the Cambodia REDD+ readiness process. Further legal analysis is given in Annex 2a.
[8] Protected Areas include the core areas of the Tonle Sap Biosphere Reserve but not the sustainable-use or transition zones (Protected Area Law 2008).

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図 8　REDD+ Roadmap の表紙

1.5　　CAM-REDD の概要（英文報告書　1.5）

CAM-REDD は 2011 年 6 月から 2017 年 11 月までの約 6 年半に亘り実施された。プロジェクトの目標と PDM は次のとおりである。

1.5.1　　プロジェクトの目標と PDM（英文報告書　1.5.1）

第 1 章「1.2　プロジェクトの背景」で述べたように、CAM-REDD はカンボジア政府による REDD+ロードマップの実施を支援するために計画されたものであり、以下のような目標が設定された。

上位目標

REDD+実施の経験に基づき、気候変動の緩和策として持続可能な森林経営が推進される。

プロジェクト目標

REDD+の戦略と政策の実施が円滑に行われるように関係者の能力が強化される。

一般的に REDD+の活動は以下のとおり 3 つのフェーズに分けられている。

フェーズ I	REDD+準備プロセス
フェーズ II	REDD+活動実施/デモンストレーション活動実施
フェーズ III	成果払いを目指した本格実施

CAM-REDD は基本的にカンボジアの REDD+フェーズ I、すなわち REDD+準備プロセスを支援するものであるが、フェーズ II に含まれるデモンストレーション活動についても一部支援した。

CAM-REDD の最初の PDM は 2011 年 3 月の本プロジェクトの内容協議の際に作成された。しかしながら、当時は UNFCCC においても REDD+の詳細な仕組みは決定されておらず、JICA 以外の開発パートナーのカンボジア REDD+支援の活動計画もまだ出来上がっていなかった。このため、PDM はその後の UNFCCC における REDD+に関する議論の進展や、UN-REDD の活動計画が明らかになるにつれて、幾度か見直しされた。表 5 に最終版の PDM を示す。

表 5　CAM-REDD の PDM（最終版）

プロジェクトの要約	指標	入手手法	外部条件
上位目標 REDD+実施の経験に基づき、気候変動の緩和策として持続可能な森林経営が推進される。	森林減少及び/または森林劣化の速さが公に認知され、その割合を下げるために政策措置が広範に取られる。	国際機関に提出される報告書類、地図、データ	
プロジェクト目標： REDD+の戦略と政策の実施が円滑に行われるように関係者の能力が強化される。	i) 必要な政策措置が国家 REDD+戦略の中に草稿される。 ii) 国家 REDD+戦略を促進するための政策レベルの省庁間の調整や関係者（ステークホルダー）の協議が進められる。	＊政府の作成する書類 ＊関係者のインタビュー結果	＊カンボジアの REDD+方針が大きく変化しないこと。 ＊財政的持続性が確保されること。 ＊国家 REDD+戦略が承認されて、必要な予算措置がされること。
成果： 1. REDD+に係る準備作業と関係者の効果的な参加の体制が国レベルで整備される。	i) 国家タスクフォース、事務局、テクニカルチーム、コンサルテーショングループが設立され、活動する。	＊大臣による Prakas/タスクフォース/アドバイザリーグループ/コンサルテーション会議、研修等の報告書あるいは議事録	＊＊REDD＋の手続きに関する国際的ルールと仕組みが遅滞なく設定されること。 ＊国家 REDD+戦略策定に十分な資源が投入されること。
2. 国家 REDD+戦略が草稿される。	i) 国家 REDD+戦略案が草稿される。 ii) セーフガードの関連セクションが国家 REDD+戦略案に盛り込まれる。 iii) 野生生物及び生物多様性法（仮称）案が閣僚評議会へ提出される。	＊大臣による Prakas/タスクフォース/アドバイザリーグループ/コンサルテーション会議、研修等の報告書あるいは議事録	

	iv) 州レベルの NFP の文書が少なくとも７州で承認される。 v) 国家/州レベルの NFP が少なくとも４州で、６プログラムを通して実施される。		
3. REDD+を準国/国家レベルで推進する能力が強化される。	i) 排出削減が少なくとも１つのプロジェクトで確認できる。 ii) 試行的準国レベルのアプローチが文書化される。 iii) CAM-REDD で支援した全てのデモンストレーションサイトでの経験が編集され、関係者に共有される。	＊報告書	
４. 森林モニタリングシステム、及び参照排出レベル（RLs/RELs）のフレームワークが設計され、各々の活動の実施能力が強化される。	i) 国家森林モリタリングシステム（NFMS）に関連したセクションが国家 REDD+戦略案の中に盛り込まれ、開始される。 ii) 初期の REL/RL が開発される。 iii) 初期の森林炭素量計測案が IPCC の Tier 1 以上のレベルで行われ、その報告用原案が認証のために作成される。	＊報告書/地図/データセット	

活動	投入		
1.1　国家 REDD+実施準備の体制を整備する。 1.2　国家 REDD+実施準備の推進を支援する。 1.3　関係者の参加を促進する。 1.4　関係者に REDD+全般に関する情報や国家 REDD+実施準備に関する情報を提供する。 2.1　国家 REDD+戦略を草稿する。 2.2　複合便益を評価する。 2.3　REDD+の資金メカニズム及び利益配分を設定する。 2.4　国家 REDD+のための政策及び法的枠組を整備する。 2.5　暫定的 REDD+排出削減枠の帳簿及び計算ルールについて概念化する。 2.6　セーフガード及び複合便益のモニタリングの仕組みを整備する。 2.7　REDD+に関連した研究調査を実施する。 3.1　デモンストレーション活動の実施と経験の整理を行う。 3.2　現場における準国/国レベルの REDD+アプローチを策定する。	日本側投入 ア. 専門家派遣： （ア）直営（長期）：チーフアドバイザー、業務調整（各 5 年間） （イ）業務実施契約：森林リモートセンシング、森林データベース、森林モニタリング イ. 供与機材：GIS 用の PC 及びソフト、衛星写真等。（このほか、環境プログラム無償による供与機材を最大限活用する。） ウ. 研修員受入：年間数名程度	**相手国投入** ア.　カウンターパート人材の配置： （ア）プロジェクトダイレクター1 名（農林水産省森林局長） （イ）アシスタントプロジェクトダイレクター1 名（農林水産省森林局次長） （ウ）プロジェクトマネージャー1 名（農林水産省森林局野生生物・生物多様性部長） （エ）プロジェクトナショナル業務調整（農林水産省森林局炭素クレジットと気候変動オフィスチーフ代行） （オ）その他のカンボジア政府関係者 10 数名程度（農林水産省森林局及び森林・野生生物研究所） （カ）事務員／秘書／タイピスト／運転手／守衛／その他 イ. 施設の提供：	＜前提条件＞ ＊無償資金協力による機材供与が大幅に遅れないこと。 ＊　関係者（FA/MoE/FiA）がプロジェクトを実施し続けること。 ＊他の開発パートナー（ドナー/NGO）との協調関係が確保されること。

活動	投入		
4.1　国家 MRV/REL を構築する。 4.2　国家森林モニタリングシステム計画を策定する。 4.3　REDD+に関連した業務に活動データを提供するための衛星による土地モニタリングシステムを設計する。 4.4　REDD+関連業務のために温室効果ガスの排出吸収係数を決定する国家森林インベントリーを設計する。 4.5　カンボジアの参照排出レベル（RLs/REL s）の枠組みを構築する。 4.6 REDD+に関連する GHG レポートシステムを開発する。		森林局内のプロジェクト事務所／設備の設置スペース／会議室(セミナー開催含む)／環境プログラム無償で供与される設備と機器／光熱費／通信費／什器備品 ウ．その他、両者で合意された設備・経費	

JICA は CAM-REDD のために 2 種類の専門家を投入した。長期専門家と、MRV/REL を主な担当分野とする専門家で構成される MRV/REL 技術支援チーム（以下、本報告書では「JICA 技術支援チーム」と呼称する）である。

長期専門家は、森林局政策アドバイザー 1 名とコーベネフィット/業務調整担当の 1 名であり、長期専門家の活動の中には、建設資材の提供などが含まれている。

1.5.2 JICA 技術支援チームの役割（英文報告書 1.5.2）

技術支援チームは 2011 年 11 月に活動を開始した。同チームが支援した PDM 上の活動は下表のとおりである。

表 6 JICA 技術支援チームが支援した PDM 上の活動

PDF での番号	活動
<成果 2>	
2.1	REDD+戦略の策定
<成果 3>	
3.1	デモンストレーション活動の実施とレビュー
<成果 4>	
4.1	国レベルの MRV/REL 体制の構築
4.2	森林モニタリングシステムの開発
4.3	REDD+関連活動に活動度データを提供するための人工衛星土地モニタリングシステムの設計
4.4	REDD+関連活動のための排出・吸収係数を開発するための、国家インベントリーのデザイン
4.5	カンボジアの RLs/RELs 枠組みの開発
4.6	REDD+に関連した GHG 報告システムの開発

また、同チームの活動は以下のとおり 3 つの期間に分けて実施された。

第 1 年次： 2011 年 11 月から 2013 年 3 月
第 2 年次： 2013 年 5 月から 2015 年 3 月
第 3 年次： 2015 年 6 月から 2017 年 11 月

1.5.3 各年次の業務

3 つの年次の特記仕様書は下表のとおりである。本報告書では、突起仕様書の内容を、下表の左の欄に示した項目別にまとめて活動内容を記述した。

表 7　特記仕様書内容

本報告書での まとめ方	第１年次	第２年次	第３年次[7]
業務計画書策定	ア.第１年次計画書の説明	ア．第２年次業務計画書の策定・説明	ア．業務計画書の説明と全体計画の策定
	イ.全体計画の策定		
能力強化	ウ.リモートセンシング/GIS 等に関する研修の企画	ウ．リモートセンシング/GIS 等に関する研修の企画	
	エ．リモートセンシング/GIS 等に関する基礎研修の実施	エ．リモセン GIS 等に関する基礎研修の実施	イ．リモートセンシング/GIS 等に関する研修の実施(活動 4.3.2)
国家森林シンベントリー設計	オ．森林インベントリー調査体制の構築支援支援	ス．森林インベントリー調査体制の構築支援支援	ウ．森林インベントリー調査手法に係る支援（活動 4.4.1）
土地利用被覆図作成技術強化	カ．土地利用と土地利用変化の評価支援	カ．土地利用と土地利用変化の評価支援	エ．土地利用被覆とその変化の評価支援（活動 4.3）
		ツ．2010 年版の土地利用被覆図の作成	
GHGインベントリーシステム	キ．排出・吸収係数の設定支援	キ．排出・吸収係数の設定支援	
GHGインベントリーシステム	ク．温室効果ガス排出量の推計支援	ク．温室効果ガス排出量の推計支援	オ．温室効果ガス排出量の推計支援（活動 4.6）
参照排出レベル設定	ケ．準国での参照排出レベルの設定支援	ケ．準国での参照排出量の設定支援	カ．国(ナショナル)での参照排出レベルの設定支援（活動 4.5）
国家森林モニタリングシステム設計	コ．森林資源情報の統合化の支援	コ．森林資源情報の統合化の支援	
国家森林モニタリングシステム設計	サ．森林炭素に係る REDD+モニタリング体	サ．REDD＋モニタリング体制の構築支援	

[7] 第三年次の仕様書の記号は、変更契約前のものを表示。

	制の構築支援		
	シ．全国レベルの森林被覆モニタリング体制の構築	シ．全国レベルの森林被覆モニタリング体制の構築支援	キ．国家森林モニタリングシステム策定支援(活動 4.2)
国家森林モニタリングシステム設計	タ．データベースの構築支援	タ．データベースの構築支援	
国家森林インベントリー設計	ス.森林現況調査（NFI）の実施支援		
デモンストレーション活動	チ．デモンストレーション活動実施支援	チ．デモンストレーション活動支援	
国家 REDD+戦略策定		テ．カンボジアの国家 REDD+戦略原稿作成支援	ク．REDD+国家戦略の策定支援(活動 2.1)
能力強化	供与機材の調達	機材購入	
評価業務		ウ．中間自己評価の実施 エ．中間レビュー調査への協	ケ．自己評価の実施 コ．終了時評価への協力
報告書作成	ツ　第 1 年次中間報告書 テ　第 1 年次業務完了報告書作成	オ．第 2 年次中間報告書 カ．第 2 年次業務完了報告書	サ．第 3 年次進捗報告書 第3年次業務完了報告書

1.5.4　　JICA 技術支援チームの構成　（英文報告書　1.5.3）

JICA 技術支援チームの構成は以下のとおりである

表 8　JICA 技術支援チームの構成

第一年次		第二年次		第三年次	
担当分野	氏名	担当分野	氏名	担当分野	氏名
業務主任 森林リモートセンシング/GIS	小野　茂	業務主任 森林リモートセンシング/GIS	小野　茂	業務主任 /REDD+戦略 /NFMS	小野　茂
副総括 森林資源インベントリー	染矢　貴	副総括 森林資源インベントリー1	染矢　貴	NFMS	坂井　勇夫
森林資源インベントリー	山瀬　岳	森林資源インベントリー2	坂井　勇夫	REL/NFMS 2	稲田　徹
森林データベース	五味　謙隆	森林データベース	古谷　透	土地利用被覆評価	古谷　透
		森林リモートセンシング・自動分類高度自動画像処理	浅井　樹	土地利用被覆評価 2	和智　明日香
				土地利用被覆評価（土地利用被覆図作成/セグメンテーション）	浅井　樹

1.5.5　　実施方針（英文報告書　1.5.4）

MRV/REL のための JICA 技術支援チームの業務実施方針は以下のとおりである。

①　基本方針

本業務の特徴は以下の 2 点に凝縮される。

- JICA と同時にカンボジアの REDD+を支援する他の開発パートナーの存在。
- REDD+という仕組みの詳細が国際社会で議論されつつある段階であり、国際動向を観ながらカンボジア政府としての到達点を決める必要性。

こうした状況へ対応するため、JICA 技術支援チームは以下のような方針で本業務を実施した。

- 他の開発パートナーとの協働

  活動の重複を避けるため、複数の開発パートナーとの連携・協調。
- UNFCCC での議論の進展への対応

徐々に細かい部分が決まっていく REDD+という仕組みに対応するために柔軟性を持たせて業務実施。

② 支援方法

JICA 技術支援チームのカンボジア政府への支援方法は以下の３種類である。

- MRV/REL 技術チーム会議、ワークショップ、その他の会合、そして実際の作業を通じての技術アドバイスの提供。（OJT）
- 講義および研修。
- ワーキングペーパーなど技術文書の提供。

③ 他の開発パートナーとの協調

JICA 調査団がカンボジア入りした 2011 年 11 月に、UN-REDD もその活動のキックオフ会議を開催したが、UN-REDD の活動を現場で管理する専門家の着任は 2013 年 1 月になってからである。それまでは FAO 本部の職員が短期出張してセミナーなどで REDD+の仕組みについての基礎的知識の醸成を図る一方、短期的に投入された専門家が主に既存の地図データの分析等を実施していた。

UN-REDD も JICA も基本的には、カンボジアの REDD+ Roadmap に記載されている項目に沿って支援を行うことになっていたが、それぞれ独自の TOR を設定していたため、その調整が必要となった。

JICA 調査団からの要請により、2013 年 7 月に FAO ローマから専門家が来訪し、プノンペンにおいて支援計画の細目調整の作業が実施され、その結果が Plan of Operation としてまとめられた。Plan of Operation は全部で 12 頁にも及ぶため、その一部を図 9 として掲載する。各活動項目については計画と実績が示されている。一番右の欄には各活動項目を支援する開発パートナー名が記載されているが、記載順序は貢献度合いとは無関係である。

その後、FCPF による支援が 2014 年から開始されたが、これについても JICA と FAO そして UNDP の専門家の間で活動内容の調整が実施された。

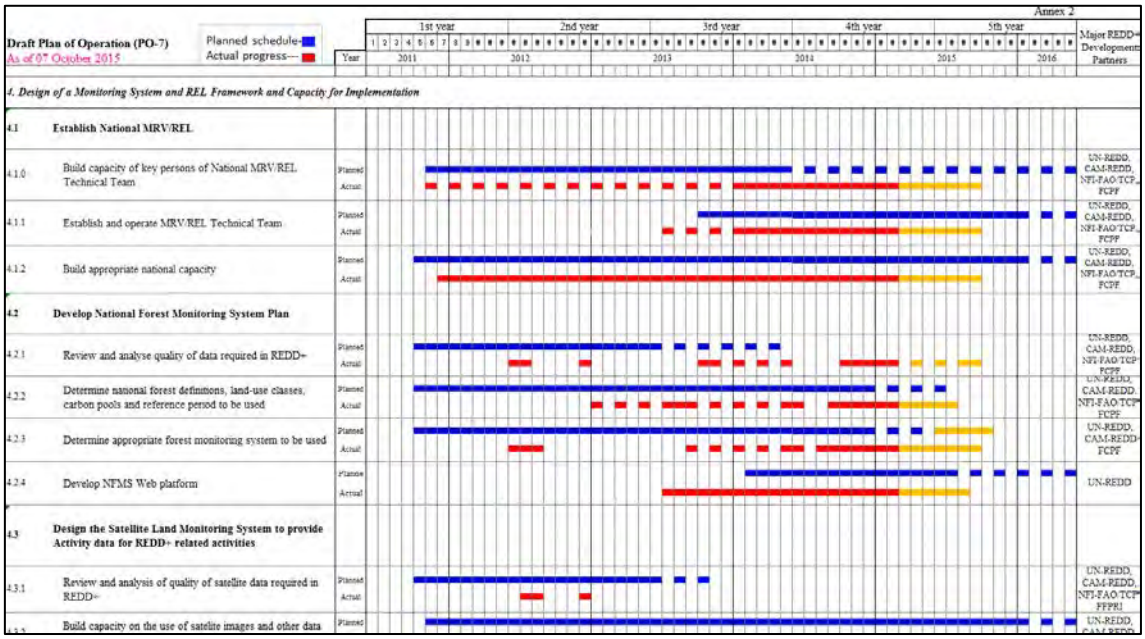


図 9　Plan of Operation の一部

④　日本政府の無償資金協力事業との協調

2010 年 3 月に日本政府は、カンボジア政府の REDD+ Roadmap 実施能力強化のために森林局に対して必要な資器材の供与を行うための E/N に署名した。この無償資金協力事業の案件名は“Forest Preservation Programme”であり、本無償案件で調達された機材の概要は下表のとおりである。

表 9　日本国無償資金協力事業で調達された資器材概要

技術分野	概要
リモートセンシング/GIS	● 森林局の事務所スペース拡大 ● GIS と人工衛星画像
森林資源インベントリー	● 森林炭素計測機器
REDD+ デモンストレーション活動	● レンジャーステーションと苗床 ● 散水車
違法伐採に対する法の執行	● 通信機器 ● 車両

無償資金協力では機器の調達だけではなく、調達した機器を使用するために以下の内容の研修も実施した。

- 森林インベントリー調査（カンボジア国内 5 か所）

- “ESRI ArcGIS”の操作
- “ERDAS Imagine”を用いた衛星画像処理
- “eCognition”を用いた衛星画像のセグメンテーション

JICA 技術支援チームは、無償資金協力担当のコンサルタントと連携を保ち、能力強化支援内容に重複や矛盾が無いよう配慮した。

1.6 カンボジアの REDD＋実施体制（英文報告書　1.6）

1.6.1 REDD+タスクフォース（英文報告書　1.6.1）

REDD+を実施するための機構として、カンボジア政府は REDD+タスクフォースを 2013 年末に編成した。2017 年 10 月時点のタスクフォースの構成員は下表のとおりである。

表 10　カンボジア REDD+タスクフォースの構成員

氏名	所属・職位(2017 年 10 月時点のもの)	タスクフォースでの役割
H.E　Chea Sam Ang	環境省自然保全保護総局長	議長
Mr　Kim Nong	環境省自然保全・保護総局 次長	副議長
H.E　Cheam Pe A	内務省地方管理総局 次長	
Mr　Net Mony	経済財務省 国家財産局局長	
Ms　Pov Voleak	工業鉱山エネルギー省 エネルギー総局　次長	
Mr　Sao Vary	土地管理都市化建設省 地籍地理総局 国家財産保全事務所長	
Mr　Dok Doma	村落開発省 村落給水部　次長	
Mr　Ouk Vibol	農林水産省水産局 水産保全部　次長	
Mr　Sam Khandy	環境省 経済的土地利用権事務局	

タスクフォースは、REDD +準備プロセスの全体的な管理、カンボジア政府内の調整を行う REDD+に関する意思決定機関である。REDD+に関する主要な成果と決定事項がカンボジアの状況に適しているかを確認し、国家 REDD +戦略と実施枠組みの開発をリードする役割を与えられている。

REDD+タスクフォースの具体的な任務は次のように規定されている。

・　国家 REDD +戦略と実施枠組みの策定

- REDD +のデモンストレーション活動の基準とガイドラインの確立
- 関係政府機関から要請される REDD +準備作業計画と予算の整理と承認
- REDD +ロードマップに記載されている主要な技術的課題のレビューのためにタスクフォースに報告する技術チームの設置
- REDD +タスクフォースと REDD +準備プロセスで作業するために提案されたコンサルタントとアドバイザーのレビュー・承認
- コンサルタント導入の承認
- ステークホルダーのコンサルテーションと意識向上プロセスの監理
- REDD +準備プロセスに関する財政支援の手配
- 他のプログラムやパートナーシップ執行機関との調整（例：UN-REDD プログラム執行委員会、関連する技術ワーキンググループ）
- 省庁内で進行中の REDD +活動に関する情報の提供
- REDD +に関する研修と会議への参加
- 開発パートナーおよび NGO の活動との調整・連携
- FLEGT の問題に関連する行動の議論・調整
- 関係省庁を代表するタスクフォース委員によるそれぞれの関係省庁への報告
- REDD +開発プロセス内で発生する争議への対処

REDD+タスクフォースは 2010 年 8 月 18 日付の政令第 99 号に基づいて、気候変動に関する調整メカニズムである国家気候変動委員会（NCCC）に必要な報告をすることになっている。UNFCCC への各種報告の提出は、NCCC を通して行われる。

タスクフォースの下には以下の４つの技術チームが編成されている。

- 利益配分
- コンサルテーションとセーフガード
- 計測報告検証/参照排出レベル（MRV/REL）
- REDD+プロジェクト：デモンストレーション活動

JICA 技術支援チームは４つの技術チームの内、計測報告検証/参照排出レベルを担当する「MRV/REL 技術チーム」を支援した。この MRV/REL 技術チームは 2013 年末近くに編成されたが、実際の活動が開始されたのは 2014 年 2 月である。その構成員は、森林局、水産局、環境省（GDANCP）、土地管理都市計画建設省、工業鉱山エネルギー省の職員各 1 名と、有識者５名であるが、REDD+フェーズ II に移行するに当たり、他の省庁の職員の参加や人数増加が検討されている。

1.6.2　　開発パートナーからの支援（英文報告書　1.6.2）

カンボジアの REDD+活動については、複数の開発パートナーが技術、財政支援をしている。主な開発パートナーは JICA と UN-REDD（FAO、UNDP そして UNEP）である。

図 10はカンボジアの REDD+準備プロセスを支援する主要開発パートナーを示したものである。

成果	主要　REDD+　関連機関 （✔✔…主担当/✔…副担当）				
	CAM-REDD JICA 技術協力	UN-REDD カンボジアプログラム	FCPF 準備プロジェクト	日本大使館	コミュニティ・保護林
成果 1：制度構築	✔	✔✔	✔✔		
成果 2：戦略・政策	✔✔	✔✔	✔✔		
成果 3：デモンストレーション活動	✔✔	✔	✔✔	✔✔	✔✔
成果 4：MRV/REL/GHG インベントリー	✔✔	✔✔	✔	✔✔	✔

図 10　カンボジアの REDD+のための各開発パートナーの支援分野

FAO は UN-REDD の一員としてだけでなく、独自の支援も展開している。

第2章 活動内容

2.1 実施計画（英文報告書 2.1）

まず第 1 年次の業務実施計画書に添付した作業フローを図 11 に示す。通常の JICA プロジェクトでは、業務実施計画について相手国政府と協議するところから調査団の業務を開始する。しかしながら、本プロジェクトの場合、調査団が「カ」国に到着した 2011 年 11 月の時点では、REDD+タスクフォースは未だ存在せず、UN-REDD の活動も開始されていない状況である。その上、「カ」国政府は、当面 JICA チームには能力強化を期待していたため、調査団が計画したような本格的活動を、調査団と共に開始する状況になかった。このため、日本で作成しておいた計画書の英訳版を用いての業務計画説明は中止し、2012 年 3 月までの暫定的かつおおまかな計画を簡略に期した書類にて、調査団の目的と計画を説明した。

その後第 2 年次が開始された時点でも、UN-REDD の明確な活動計画が出来ておらず、業務の重複を避けるため、MRV/REL 分野の体制整備のために必要な作業項目の関係だけを示したワークフロー（図 12）を作成して UN-REDD 側の計画との調整を行ってから、JICA 技術支援チームの作業計画の詳細を策定することとした。ただし、森林インベントリー調査手法に関する支援、土地利用と土地利用変化の評価支援、排出・吸収係数の設定支援などはお互いに影響を及ぼす性質のものであるために、REDD+体制整備に係るほとんど全ての作業は並行して実施される結果となった。その傾向は図 13 に示す第三年次のワークフローでもより顕著になっている。

カンボジアの REDD+の活動計画が明らかになってくるのは、REDD+タスクフォースの下に 4 つのテクニカルチームが編成され、会合が開けるようになった 2014 年初頭であるが、JICA 技術支援チームはそれを待たずに、2013 年 7 月にとりあえず UN-REDD（FAO）との間で両者の作業内容と予定の確認ならびに調整を行った。

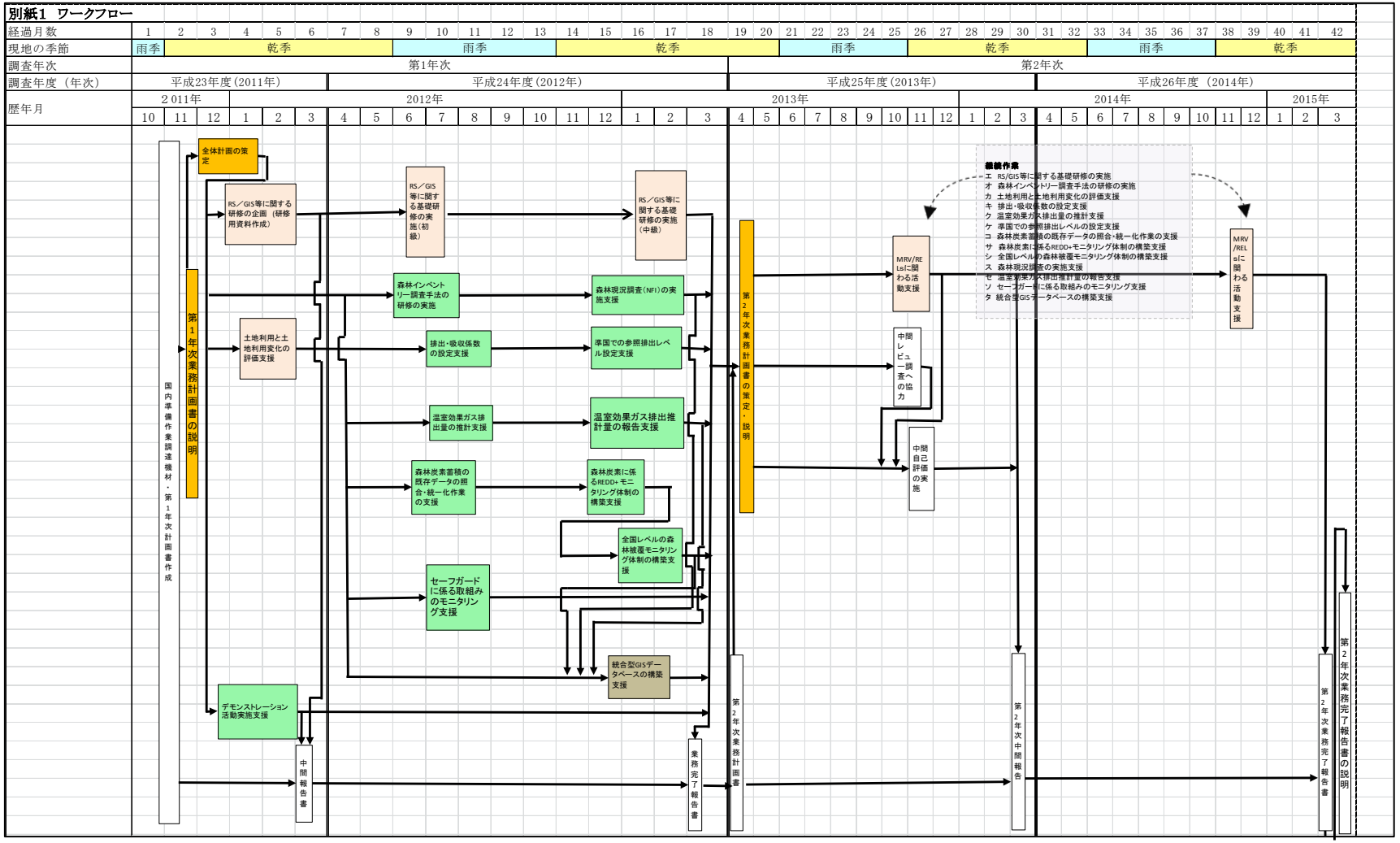


図 11　第 1 年次当初の計画書

カンボジア国REDD+戦略政策実施支援プロジェクト　作業工程計画

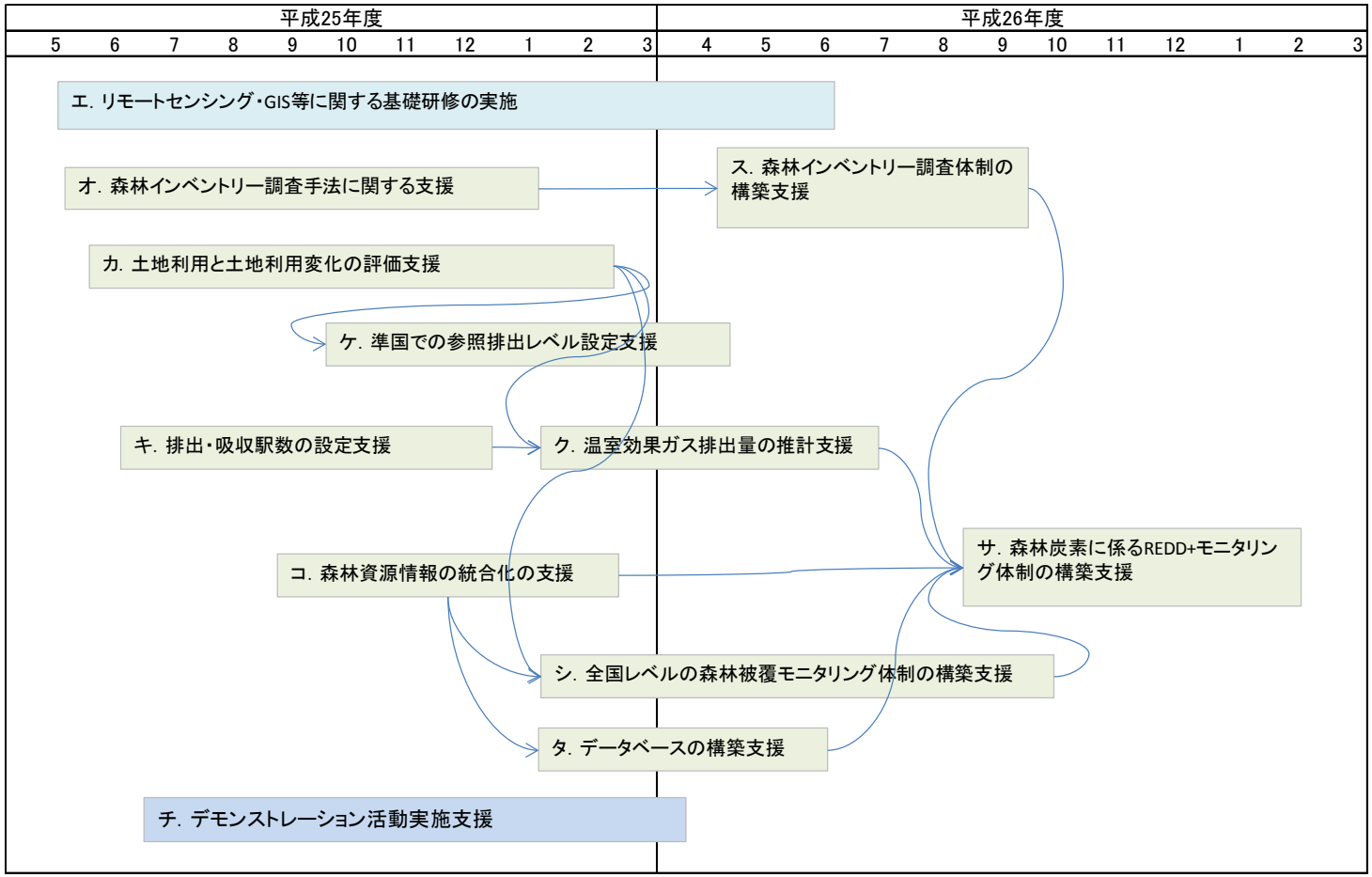


図 12　第 2 年次作業工程計画

カンボジア国REDD+戦略政策実施支援プロジェクト第三年次　ワークフロー

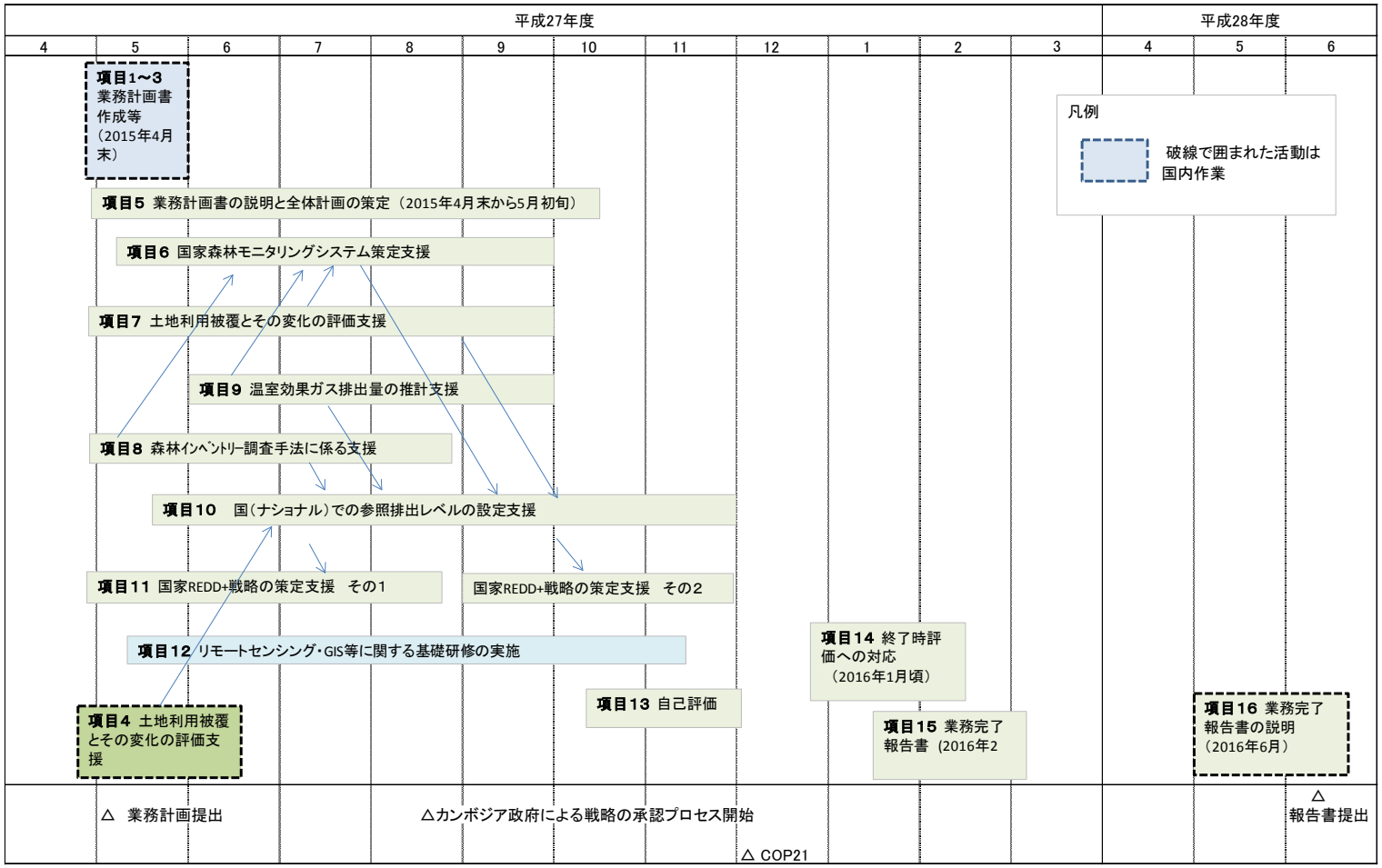


図 13　第 3 年次作業計画（ワークフロー）

Action Plan for MRV/REL Technical

Date: 24 Apr 2014

Team Member:

Team Facilitator:

No	Output	Activities Action Plan (Feb-Dec 2014)	Description of activities	Materials made by JICA/UN-REDD/FAO
1	**4.1 National MRV/REL (Capacities and Operation)**	1. MRV/REL Technical Team operation	1. Clarify role and responsibility of the MRV/REL team	**Presentation roles and responsibilities GHG-I**
			2. Identify items (ToR) of work the team needs to carry out	
			3. Determine operation, location, materials and equipment etc.,	
2		2. Monthly MRV/REL TT meetings	1. Sum-up monthly activities and report to taskforce	
3		3. Team capacity assessment and link to institutional roles	1. Assess the capacity of each member of the team (estimate time each member can use for the activity of the team)	
			2. Prepare individual training an monitoring plan	"UNDERSTANDING IPCC GUIDDELINES 2006 FOR FOREST INVENTORY FOR REDD Ver.1.0" 2013
4		4. Determination of institutional roles in REDD+ monitoring and MRV	1. Base on existing laws, structures, processes to review roles and responsibilities related to MRV/REL	
5		5. Identification of fields which require capacity building.	1. Institutional capacity assessment	Questionnaire prepared
6		6. Trainings and exchange visit	1. Trainings	
			2. Exchange visit (based on capacity needs assessment)	
7		7. Develop syllabus	1. Remote Sensing (RS) note 2. RS manual 3. Publication	
8		8. Consultation workshop	1. MRV workplan	
			2. RS syllabus	

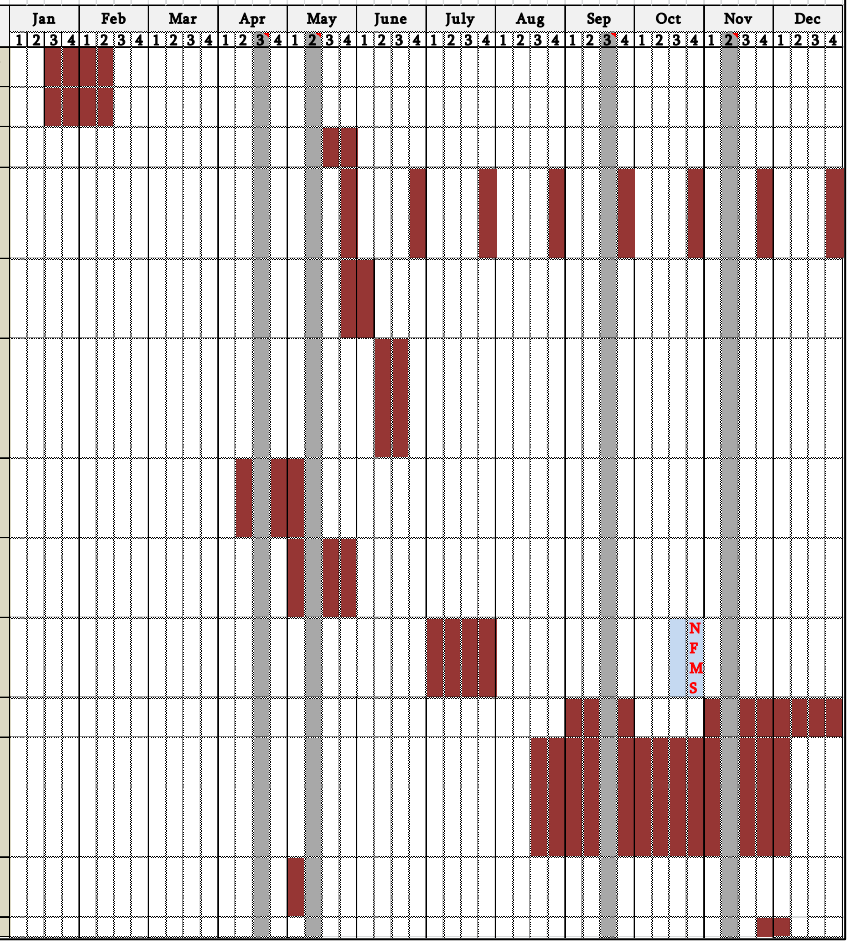


図 14　MRV/REL 技術チームの活動計画

2.2 活動実績 （英文報告書 2.2）

2.2.1 概要

2011 年から 2017 年の 6 年間で、カンボジア政府は REDD+準備プロセスを粗方終了した。すなわち、UNFCCC の仕組みの中で REDD+活動の成果に対する支払いを申請するための条件である以下の４つの仕組みをほぼ構築し、あるいは設計を終了し、REDD+の次の段階に移行しようとしているところである。

- 国家 REDD+戦略（NRS）
- 国レベルの森林排出レベル（FRL）
- 国家森林モニタリングシステム（NFMS）
- セーフガード情報システム（SIS）

2017 年 10 月にカンボジア国内で開催した、本業務の最終セミナー用に、カンボジアの主に MRV/REL と NRS に関するこれまでの進捗と今後の活動について簡潔に説明した資料を作成したので別添資料 1 として添付する。また収集資料リストを別添資料 6 として添付する。

カンボジアの REDD+準備プロセスの進捗を年次別に示すと表 11 のとおりである。

ひとつ注意すべきことは、これまでに作成された各種設計書や計画書は、今後以下のような要因によって変更あるいは改良される性質のものであることである。

- 政府組織の改編
- 第三者が作成したデータ使用に関する方針
- GHG インベントリーのティアレベルに関する方針
- 使える予算と人的資源
- 技術革新
- 政府職員の技術能力の向上

実際、カンボジア政府の森林・環境セクターの組織改編はまだ完了しているわけではない。森林局や環境省の地方事務所はすでに州政府の一組織となっているが、REDD+活動実施の際の役割や予算措置などはまだ十分検討されておらず、こうした制度組織が固まるには今しばらく時間が掛かる。

表 11　第 1 年次から第 3 年次までの活動概要

REDD+準備プロセス項目	進捗状況		
	第 1 年次	第 2 年次	第 3 年次
REDD+国家戦略の策定 (活動 2.1)		第一稿作成。	完成。カンボジア政府の承認プロセス中。
デモンストレーション活動（活動 3.1）	Oddar Meanchy Community Forest と Seima Protection Forest での REDD+プロジェクトの、それぞれ検証と有効化審査終了。Seima プロジェクトの炭素クレジットの一部は販売された。		
リモートセンシング・GIS 等に関する研修の実施 （活動 4.1）	森林局を対象とした研修の実施。	森林局と水産局を対象に研修の実施。	主に森林局に対する OJT と、環境省に対する講義・実習の実施。
国家森林モニタリングシステム（NFMS）策定 （活動 4.2）	カンボジアの現状分析を実施。 NFMS の内容についての検討はカンボジア側の体制が整わず十分実施できず。	MRV/REL 技術チームでの議論や専門家チームの検討結果をまとめ、NFMS 策定計画をワークショップで確認。 MRV/REL 技術チームでの検討は不十分。	Ver1 完成。
土地利用被覆とその変化の評価支援 （活動 4.3）	既存の森林図の内容と手法の分析を行い、2006 年、2010 年地図の改良と 2014 年版新規地図の作成手法を検討。	REDD+のための森林定義を決定。 さらに、REDD+のための新たな土地利用被覆クラスを設定し、新たな手法を導入して 2006 年、2010 年地図の改良と 2014 年地図の新規作成作業を途中まで完了。	2006 年、2010 年、2014 年、2016 年版の土地利用被覆図完成。 2016 年版作成のために、さらに新しい手法を導入。
森林インベントリー調査手法	既存の森林調査の分析と NFI 設計	NFI 設計書案と現地調査マニュアル案	NFI 設計原稿と現地調査マニュア

に係る支援 （活動 4.4）	書の作成。	が作成され、FAO により第三者の査読に廻された。	ル原稿が出来上がり、現在クメール語版を編集中。
国での参照排出レベルの設定支援 （活動 4.5）	排出の試算と、教育用資料の作成。	設定方法原案まで作成。検討は不十分	最初の参照排出レベルが算出され、UNFCCC に提出された。現在、UNFCCC による技術審査が行われている。
温室効果ガス排出量の推計支援 活動 4.6)	IPCC ガイドラインの分析と教育用資料の作成。	MRV/REL 技術チームでの方法検討を実施。手法の選択には至らず。	２種類の排出量推計手法に必要なデータの種類と質を明らかにし、かつ推計方法を指導。

2.2.2　　能力強化（英文報告書第 2 章　2.2.11）

PDM においては成果 1 から 4 全てについて、その活動の中にカンボジア政府職員の能力強化が含まれている。

能力強化のための方法としては、クラスルーム形式の講義、教科書や解説書による自習、実際に手を動かす研修（トレーニング）、そして実際の仕事を実施しながら指導を受ける On the Job Training（OJT）の 4 種類の方法を用いた。さらに研修や OJT のために必要な機材の導入も実施された。

研修・資料作成・セミナーなど

JICA 技術支援チームは、基礎的な内容についての講義研修は主に 2012 年から 2015 年の間に、対象者を一同に集める形で実施した。研修リストは以下のとおりである。

表 12　研修リスト

日付	内容	対象者
2012 年 1 月 25 日，26 日，27 日	初心者に焦点を絞り、リモートセンシングと GIS の基礎について原理等を講義した。	森林局 12 名
2012 年 2 月 20 日、21 日、22 日	1 月の研修について復習したうえで、リモートセンシングおよび GIS を用いた図化作業について具体的な事例を示して説明した。	森林局 12 名
2012 年 7 月 4 日、5 日，6 日	前半は REDD+の意味、REDD+ ロードマップの内容、そして IPCC ガイドラインの概要など、REDD+に関する基礎知識を講義し、後半は衛星画像判読による土地被覆図作成の実習を行った。	森林局 14 名
2012 年 10 月 22 日	森林インベントリー調査用機材の使用方法実習	森林局 13 名、王立農業大学 2 名
2012 年 7 月 6 日、8 日、26 日	GIS データベース	森林局 3 名
2013 年 3 月 1 日、5 日	リモートセンシングの基礎	水産局 6 名
2013 年 9 月 9 日 10 日 11 日、12 日、13 日	eCognition の操作方法	森林局 13 名
2013 年 9 月 25 日、26 日，27 日	衛星リモートセンシング マングローブ地区の判読	水産局 4 名
2014 年 3 月 10 日	マングローブ地域の衛星画像判読	水産局 8 名
2015 年 7 月 27 日、28 日、29 日、30 日、31	リモートセンシング、GIS、地図作成 土地利用計画策定への GIS の活用	環境省 Geo Information

日		Service Dept 9 名
2015 年 8 月 31 日、9 月 1 日、2 日、3 日、4 日	リモートセンシング・GIS ゾーニング計画策定	環境省 Geo Information Service Dept 9 名

表 13 に JICA 技術支援チームが作成したワーキングペーパーのリストを示す。ワーキングペーパーは、カンボジア政府に対してその都度必要な情報を提供することを目的としたものであるため、出版用に作成されたものではない。

表 13　ワーキングペーパーのリスト

番号	タイトル
WP#1	Simulation / Trial Calculation of RELs (Reference Emission Levels) of Cambodia with Different Scale Approach
WP#2	Trial Calculation of Historical Trend of Annual CO_2 Emissions/Removals in order to Understand Cambodian Nationwide RELs (Reference Emission Levels)
WP#3	Guide to calculate forest living biomass
WP#4	Review on existing forest carbon data and provisional design of national forest inventory in Cambodia
WP#5	Revision of provisional national forest inventory design (incorporating ITTO C&I[8] and NFMA[9] requirements)
WP#6	Available allometric equation for Cambodian REDD+ and possible works for tentative estimation of living biomass
WP#7	Trial calculation of above ground biomass in Cambodia
WP#8	Essence of the procedure for C stock estimation and reporting by IPCC guideline
WP#9	C stock change by method 1 with tentative activity data and default emission factors
WP#10	Literature review on forest biomass density of Cambodia Ver.1
WP#11	Data required for GHG inventory by two methods
WP#12	The number of survey points of NFI and the precision in estimating forest area and biomass
WP#13	Some remarks on the usage of GHG inventory software in AFOLU sector

8 ITTO(2005) Revised ITTO criteria and indicators for the sustainable management of tropical forests including reporting format. http://www.itto.int/policypapers_guidelines/?pageID=2

9 “Manual for integrated field data collection – National Forest Monitoring and Assessment” (NFMA Working Paper No.37/E Rome) published by FAO in 2012.

WP#14	Identification of appropriate above ground biomass for emission factors in Cambodia REDD+ program
WP#15	Supplementary NFI design and field manual

また JICA 技術支援チームは、ワーキングペーパーに加えて、以下のような技術メモを作成してカンボジア側に提供した。

表 14　JICA 技術支援チーム作成の技術メモ

技術メモ名	内容
● Second revised provisional NFI design for carbon estimation in Cambodia (December 2013)	NFI 設計
● Forest inventory training manual focusing on REDD-Plus for the Kingdom of Cambodia – Intermediate Class (March 2013)	NFI 研修手引き
● Understanding IPCC guidelines 2006 for forest inventory for REDD (March 2013)	IPCC ガイドライン
● Basics of GPS, satellite remote sensing and GIS technology for forest resource survey (March 2013)	GPS、リモートセンシング、GIS の基礎知識
● Technical report on the use of eCognition for forest cover mapping (September 2013)	eCognition の使用法
● Introduction of object base satellite image analysis method (Slide presentation, September 2013)	オブジェクト分類の基礎
● Practical use of eCognition for forest cover mapping (February 2014)	eCognition の実践的な使い方
● Methodology for logical check of forest cover map (2010) (March 2014)	森林地図の論理チェック方法
● Concept paper for mapping for initial REL/RL establishment for Cambodian REDD+ (August 2014)	Initial REL/RL のための地図作成方針
● Trail calculations of Carbon stock change by gain-loss method and lessons learned from the experiences (Sept 20, 2014)	Gain Loss 方法による炭素蓄積の試算
● Methodology for compilation of forest cover map of 2010 (October 2014)	2010 年地図編集の方法
● Land cover type of Sihanouke Province (October 2014)	シアヌークビル県の土地被覆タイプ
● Selection of emission factor for Cambodia (February 2015)	カンボジアのための排出係数の選定
● GHG Inventory Method for Cambodia (February 2015)	カンボジアのための GHG インベントリー手

	法
● Forest Inventory Survey Method for Cambodia (February 2015)	カンボジアのための森林インベントリー調査手法
● Land use and land use change assessment method for Cambodia (March 2015)	カンボジアの土地被覆と土地被覆変化評価
● Calculation of Initial Reference Emission Level for Cambodia (March 2015)	カンボジアの Initial REL の計算

さらに JICA 技術支援チーム単独あるいは FAO（UN-REDD）との共催により、NFMS や FRL に関して、2014 年 12 月、2015 年 10 月そして 2015 年 11 月と計 3 回のセミナーを開催した。また 2017 年 10 月にはこれまでの 6 年間の活動を総括する最終セミナーを開催した。JICA 技術支援チームが出席した主な会合は別添資料 2 に添付する。

機材供与

カンボジア政府森林局に対しては、後述のように日本政府の無償資金協力事業で、REDD+ロードマップ実施支援のために機材が供与されたが、その調達には時間が掛かることが予想されたため、第 1 年次には JICA 技術支援チームによる研修に必要なパソコン、ソフトウエア、衛星画像、森林の地上調査機器だけを調達した。

調達機材のリストは以下のとおりである。

＜第 1 年次＞

第 1 年次には森林局と水産局に対して、GIS や森林調査のための機材を調達して引き渡した。（表 15、表 16）

表 15　森林局向け供与機材

品名	銘柄・仕様	調達数量	
		RS/GIS 用	森林インベントリー用
サーバ	MS Windows Server2010	1	
外付けハードディスク	2 TB	2	
UPS	Power rating 3000VA/2700W	1	
デスクトップコンピュータ	22 インチモニター Windows7 Professional	3	1
ラップトップコンピュータ	14 インチモニター Windows7	3	1

	Professional		
GIS ソフト	ESRI ArcGIS ArcView V.10 Single User	3	2
ウイルス対策ソフト	Antivirus (10 user licenses)	2	1
レーザープリンタ	カラー、A3 サイズ	2	0
スキャナ	カラー、A3 サイズ	2	0
GPS	携帯型、付属品	4	2
巻尺	50 m	5	

表 16　水産局向け供与機材

品名	銘柄・仕様	数量
ラップトップコンピュータ(ウイルス対策ソフト付)	14 インチモニター Windows 7 Professional	1
A3 インクジェットプリンタ・スキャナー複合機		1
Wifi アダプター	300 mbps	1
外付ハードディスク	1 TB	1

＜第 2 年次＞

２年次には、環境省向けの機材を調達し引き渡した。詳細は下表のとおりである。

表 17　環境省向け（本邦調達分）

品名	銘柄・機種	調達数量
レーザー距離計	Haglof 15-100-1001	1

(注：　第 1 年度に調達したものを第 2 年次に引き渡した)

表 18　環境省への供与機材リスト（現地調達分）

品名	銘柄・機種	調達数量
デスクトップコンピュータ	Dell Inspiron 3000 Windows8 Professional	1
ラップトップコンピュータ	Dell Inspiron 3437 Windows8 Professional	1
GIS ソフト	ESRI ArcGIS ArcGIS Desktop Basic Single User License	2
ウイルス対策ソフト	Bit Defender Total 2014 (3 user licenses)	1
インクジェット複合プリンタ	Epson WorkForce WF7621	1

ー	プリンター/スキャナー	
GPS	Garmin GPSMap 64S	2

＜第 3 年次＞

第 3 年次には、環境省に対して以下の機材を供与した。

主に保護区土地利用計画策定用

品名	銘柄・仕様	数量
デスクトップパソコン	DELL Inspiron 3000、モニター、Windows 8 OS、Microsoft Office Home Business	2
GIS ソフトウェア	ArcGIS Desktop Advanced	1
GIS ソフトウェア	ArcGIS Spatial Analyst	1
ラップトップパソコン	DELL Inspiron 5000、Windows 8 OS、Microsoft Office Home Business	1
外部ハードディスク	4TB	1
ウイルス対策ソフト	Internet Security	1

土地利用被覆図作成用

品名	銘柄・仕様	数量
デスクトップパソコン	DELL Inspiron 3000、モニター、Windows 8 OS、Microsoft Office Home Business	1
ウイルス対策ソフトウェア	Internet Security	1

なお、第 3 年次業務終了にあたり、第 1 年次に調達し、JICA 技術支援チームが使用してきた以下の機材を、環境省の自然保全保護総局　監査・法執行部に引き渡した。

＜本邦調達＞

品名	銘柄・仕様	数量
RS 用ソフトウェア	ERDAS Imagine Advantage2011	1
RS 用ソフトウェア	ERDAS Imagine Professional 2011	1

＜現地調達＞

品名	銘柄・仕様	数量
デスクトップコンピュータ	23 インチモニター Windows7 Professional、Microsoft Office Pro 付	1
GIS 用ソフトウェア	ESRI ArcGIS Desktop Basic Single User License	2
ウイルス対策ソフトウェア	Antivirus	1

2.2.3　　国家森林モニタリングシステム設計（英文報告書第 2 章　2.2.5 及び 2.2.6）

①　活動内容

国家森林モニタリングシステム（NFMS）の設計が完了した。

NFMS の設計は、以下の条件に配慮しながら進められた。

- 土地利用被覆評価手法と更新サイクル
- 国家森林インベントリー手法とスケール
- カンボジア政府の衛星土地モニタリング能力
- カンボジアの国別報告、隔年更新報告書の提出予定
- カンボジアの参照排出レベルの提出予定

森林伐採や劣化に対して有効な施策を計画するには、森林だけでなく対象地域や国全体の社会経済条件に関する信頼できる情報が必要である。また、NFMS の構築は、REDD+での成果払いを受けるための 4 つの条件のひとつとなっている。

カンボジアは本プロジェクトが開始された 2011 年 11 月以前から森林モニタリングを実施していた。すなわち 2002 年からは、4 年おきに森林図や土地利用被覆図が作成されている。森林インベントリー調査は部分的であり、また全土をカバーすることを目的としたものではないが、実施されている。さらに森林局、環境省、水産局共に、地方事務所からの報告書を定期的に中央事務所に提出する仕組みを有している。[10]

上記の状況を鑑み、カンボジアは既存の仕組みを元に、NFMS をできるところから始める形で構築することにした。目標は 5 つの炭素プールをカバーした Tier2 レベルの GHG インベントリーができるようなシステムである。

NFMS の設計は、MRV/REL 技術チームが編成される前からその作業が開始された。既存の地図と森林インベントリー調査のデータの解析が行われ、改良の方法について UN-REDD と JICA の支援で検討された。

NFMS の設計作業が本格化したのは、MRV/REL 技術チームが実際に活動を開始してからである。NFI の設計案の作成が、既存の土地利用被覆クラスの見直しと同時に行われた。

[10] 2016 年の環境・森林セクターの改編により、森林局、環境省、水産局の地方事務所はそれぞれ州政府に吸収された。州政府から中央政府機関への情報伝達あるいは報告のルールについては、確認できていない。

また、新たな地図作成技術の導入検討も行われ、データベース管理システムと WEB ポータルの構築も開始された。

2014 年 12 月には NFMS に関する最初のワークショップが開催され、NFMS 設計の進捗状況が報告され、それ以後の予定などが説明された。

NFMS の設計書 Ver.1 は 2016 年 3 月までに完成した。(別添資料 3 参照)この Ver.1 では、NFMS の全体のデザインが図 15 のように提案されている。

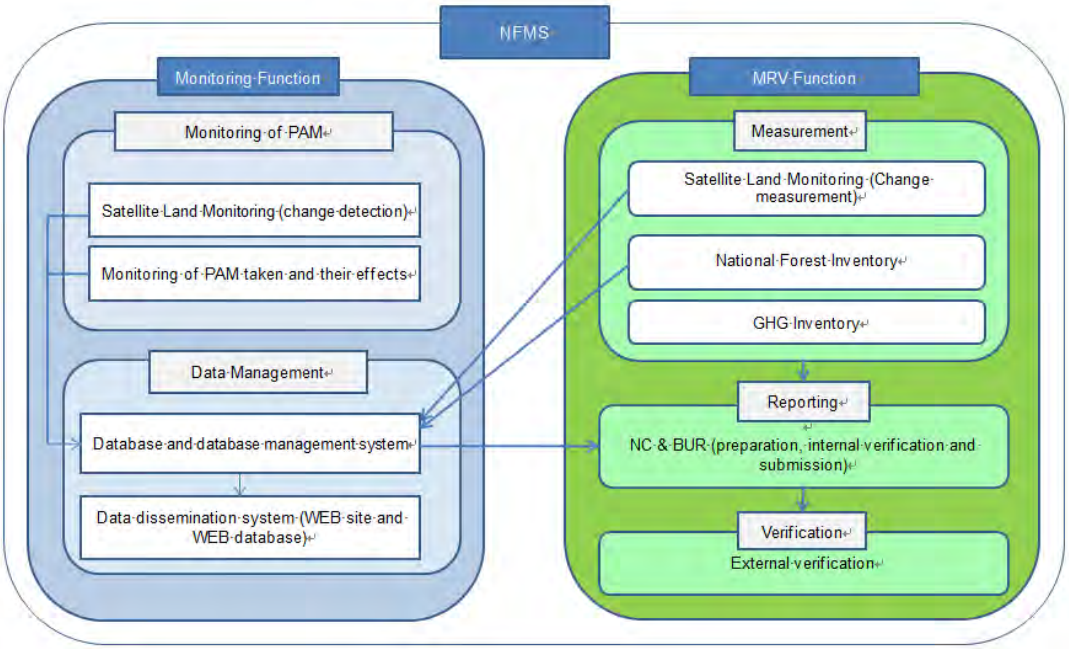


図 15　カンボジアの NFMS の構成

NFMS は MRV とモニタリングの２つの機能を有する。MRV 機能とは、GHG インベントリーそして UNFCCC への報告に使われる、GHG の排出吸収を測るためのものである。モニタリング機能は、森林減少劣化を抑制するために導入される施策の効果をチェックするものである。衛星による土地モニタリングはどちらの機能にも使えるものである。

モニタリング機能に含まれているのは、データ管理機能であり、１）データベースとデータベース管理システム、２）データ配布システム（WEB サイトと WEB データベース）から構成されている。

2017 年 10 月までに、WEB デザインも含め、データ管理システムのプロトタイプデザインが終了している。現時点ではセキュリティー管理の観点から、データベースはインターネットには接続していない。WEB で公開されるデータの種類と内容については、現在も議論が継続中である。

② JICA 技術支援チームの役割

JICA 技術支援チームは、NFMS の最初の設計原稿および、MRV/REL 技術チームの会議で検討されるさまざまな技術資料を作成した。また、NFMS 設計の全行程にわたり、必要な技術アドバイスを提供した。

③ 今後の活動

現在の NFMS 設計書では、NFMS の開発を以下のようなスケジュールで行うこととしている。

フェーズ I ：準備段階 (2011 年-2015 年).
フェーズ II ：開発段階 (2016 年-2020 年)
フェーズ III ：運用段階 (2021 年から)

NFMS は現在使用可能な技術に基づいて設計されている。このため、森林劣化の計測やモニタリングは未だ計画されていない。また、森林減少・劣化を抑制するための活動の効果をモニタリングする手法については、まだ十分検討されていない。そうした活動は、対象地域での森林減少・劣化の原因によって決まるものであるが、カンボジアでは現在、未だ対象地域を選定する段階であるため、モニタリング手法を特定できない状況である。

対象地域を選定後、詳細なドライバー分析を行い、その結果に基づいて、REDD+戦略・方針が決定され、その後、モニタリング方法が決まるという順序となる。当然のことながら、REDD+活動の成果を測る最適な指標は森林面積の動態であるが、対策の種類によっては他の指標も使用可能である。

さらに、NFMS Ver1 は、カンボジアの森林・環境セクターの改編が本格化する前にその骨格部分が策定された。このため、今後、同セクターの改編が完了する時点で、関係組織の責任に関する記述部分については更新する必要がある。

2.2.4 国家森林インベントリー設計（英文報告書第 2 章 2.2.8）

① 活動内容

NFI 設計書と現地調査マニュアルの英文原稿が完成し、現在クメール語版の編集が行われている。クメール語版完成後、カンボジア政府の承認プロセスに入る。

NFI は NFMS の一部分である。カンボジアの NFI の設計は、カンボジアにおける過去の森林調査の分析から開始された。カンボジアではこれまで国土全体の森林を網羅する森林調査は計画されていなかったため、必要なサンプル数の算出も行われた。

NFI の設計案は、図 16 に示すように、JICA 技術支援チームと FAO が相互に補完しながら作成された。

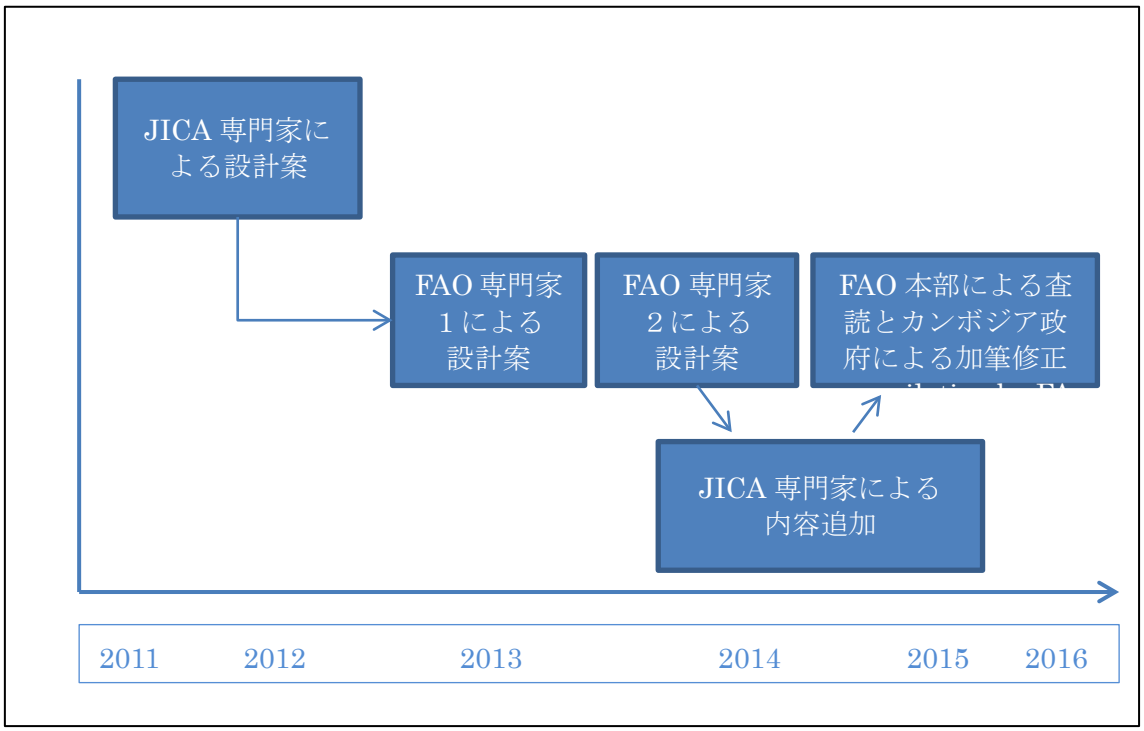


図 16　カンボジアの NFI 開発

2014 年の中盤に、NFI と現場作業マニュアル原稿ができた段階で、FAO 本部は同原稿を複数の海外の大学に送り査読を依頼した。査読の終わった設計案とマニュアルは MRV/REL 技術チームに提出され、主に森林局の職員によって加筆修正が行われた。その際、JICA 技術支援チームが提供した技術資料からも必要な内容が取り入れられた。

2017 年 10 月時点での NFI 設計の要旨は以下のとおりである。

- クラスター数：　3,170 点
- プロット数：　1 クラスター当たり 3 プロット（L 字型）
- プロット形状：
  - マングローブ林：　円形
  - マングローブ林以外：　四角形
- 調査・計測項目：
  森林タイプ、樹種、DBH、樹高、下草の状況、枯死木の数、倒木の数、リター量、土壌中の炭素量
- 実施期間：　4~5 年

現在クメール語版の NFI 設計書と現地調査マニュアルが最終的な編集に入っているとこ

ろである。

② JICA 技術支援チームの役割

第 1 年次において、JICA 技術支援チームは、森林局からの情報を元に、カンボジアの森林炭素蓄積に関わる既存データの現状と課題を表 19 としてとりまとめた。

表 19 カンボジアにおける森林炭素蓄積に関する既存データの現状と課題

項目	現状と課題	備考
森林局が関与する既存調査	・ 森林局が関与する既存調査としては、1) PSP 調査、2) 森林コンセッション調査、3) REDD パイロットプロジェクトでの調査がある。 ・ PSP 調査は、森林局が国際ドナーや日本の研究機関の協力のもと実施している。1998 年開始時 121 地点（森林局 2004）あったが伐採、火入れ等により現在約 70 地点まで激減している。 ・ 森林局による 15 箇所の森林コンセッション（Forest Concessions）の調査データ（計 6940 地点）があるが、一元的に管理されていない。 ・ 国際 NGO が森林局と共同で実施している REDD パイロットプロジェクトでは各サイト（オッドミアンチェイ州、プレアビヒア州、セイマ等）で森林炭素蓄積の調査が実施されている。	Kiyono et al.（2010）は環境省の管轄する保護区で森林調査を実施。浸水林（Flooded forest)に関してはトンレサップ湖畔における荒木（2007）のみ。マングローブ林の森林炭素に関わる既存データはない（現時点では未確認）。
調査プロット数	・ PSP データ以外では、2002 年以降の調査で、調査位置または範囲が特定できた調査プロットは約 200 地点。	
調査プロット位置	・ 既存データでは全国を十分にカバーできていない。特に、標高 800m 以上での既存データはない。地域的にみると、中央カルダモン山地部、モンドルキリ州北部、ラタナキリ州北部等では既存データはない。 ・ 森林総研、九州大学が継続して調査を行っているコンポントム州では既存データが充実している。	PSP は 5 つの州に偏って配置されている。
調査プロットサイズ・形状	・ 調査面積は方形区による 50m x 50m（0.25ha）、20m x 60m (0.12ha)、円形プロットによる 0.5ha、0.1ha 等、調査の実施主体によって異なる（図 2-3-1）。いずれも、入れ子状のプロットを設けて、段階的に異なる幅の DBH を計測することで効率化を図っている。	Plots と Cluster を区別して取り扱うよう注意が必要。
計測対象（5 炭素プール）	・ 既存調査のほとんどが地上部バイオマス（AGB：Above Ground Biomass）を対象にしている。 ・ 土壌有機物（SOM：Soil Organic Matter）以外の 4 つの炭素プールを対象にした調査としては Kiyono et al.（2010）がある。 ・ SOM については、Toriyama et al.（2010a）があるが調査地点は限られている。	3 つの REDD パイロットプロジェクト（オッドミアンチェイ州、セイマ、シエムパン）では、いずれも AGB、BGB（AGB の比率計算）、枯死木

		（DW：Dead Wood）を対象としている。
計測項目	・ いずれの既存調査においても、樹種、DBH（胸高直径）、樹高（または枝下高）は計測対象となっている。	樹高（Total height）と枝下高（Stem height）を区別する必要がある。
実測（生）データ	・ PSP データは、森林局（担当：Vanna 氏）が管理している。 ・ 国際 NGO が森林局と共同で実施している REDD パイロットプロジェクトのデータについては利用可能性が高い。	2013 年 2 月時点では PSP データは森林局から貸与されていない。

また、森林局から提供あった資料から作成した森林調査の位置は、図 17 のとおりである。この分析から、表 19 にも記載されているとおり、標高 800 メートル以上の地域での調査は実施されていないことが明らかとなった。また浸水林とマングローブの調査もわずかしか実施されていないことも確認できた。

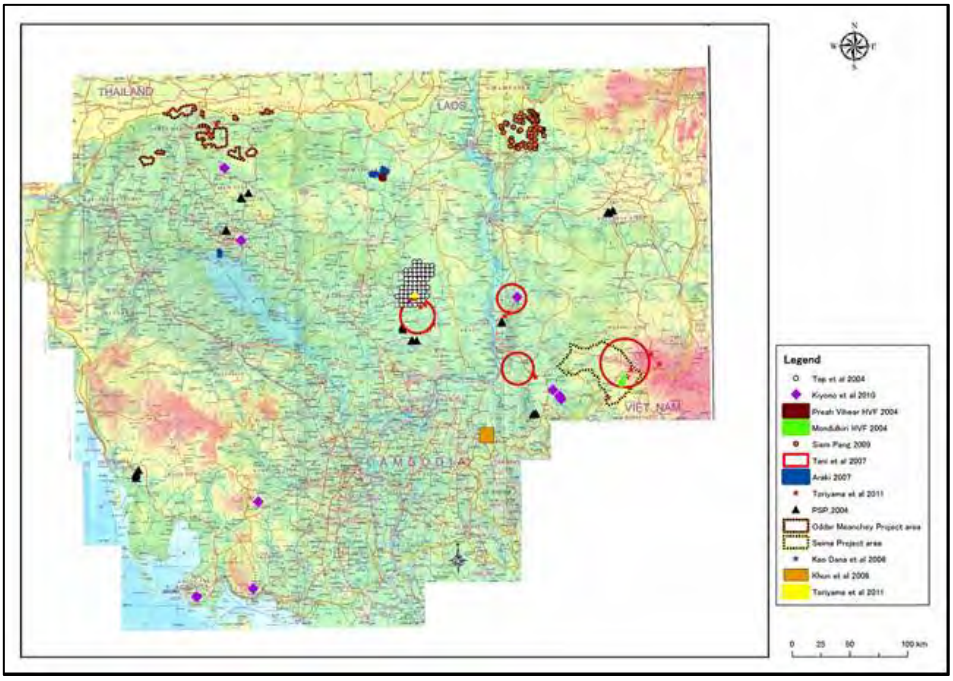


図 17　森林調査地域図

JICA 技術支援チームは、このような現状分析結果に基づいて NFI の最初の構想を作成し、2013 年 3 月までに森林局に提供した。その後 FAO が NFI 設計の専門家を 1 名雇用し、JICA 技術支援チームの NFI 構想を参考にしながら、NFI 設計を行った。JICA 技術支援チームは FAO 専門家と頻繁に意見交換し、かつ MRV/REL 技術チームに対して NFI に関する技術資料を提供した。主要な技術資料 2 点の要旨は以下のとおりである。

(1)　NFI 設計と現場作業マニュアルへの補筆事項

この技術資料では、まず FAO の設計でカバーされていない事項を次表のように明らかにした。

表 20　NFI 設計と現場作業マニュアルでカバーされている項目

炭素プール	サンプリング設計	現地調査法	試料分析法	アロメトリー式	データ処理方法
AGB	Yes	Yes		No	No
BGB				No	
Dead wood	Yes	Yes	No		
Litter	Yes	No	No		
Soil	Yes	No	No		

上表で FAO の NFI 設計と現場作業マニュアルでカバーされていない項目について、“Supplementary NFI Design and Field Manual”というタイトルの Working Paper として取りまとめカンボジア側に提供した。その内容は以下のとおりである。

1 Purpose of this document
2 Fieldwork for litter and soil
2.1 Field team
2.2 Field equipment per team
2.3 Sampling location at a plot
2.4 Sampling in the field
2.5 Packing samples in the field
3 Laboratory works
3.1 Laboratory works for litter
3.2 Laboratory works for soil
4 Other considerations
4.1 Slope distance adjustment
4.2 Partial revision of field forms
4.3 Checklist of tree species name
4.4 Selection of allometric equation
4.5 Preparation for data processing
5 Cost of NFI
6 References
Annex 1: Preliminary checklist of tree species
Annex 2: Example of possible allometric equations for Cambodia
Annex 3: Preliminary list of wood density by species

(2)NFI の調査点数と精度

FAO の設計によるとクラスター数は 3,170 点となる。この点数では実施が困難になると予想されたため、点数を減らした場合の精度について検討した、“The Number of Survey Points of NFI and the Precision in Estimating Forest Area and Biomass”

というタイトルのワーキングペーパーを 2015 年 8 月に作成した。

表 21 は、このワーキングペーパーに掲載した精度分析の一部である。クラスター数を 3,170 点から 1/4 の 1,357 点まで減らした場合のバイオマス密度推定の精度について示し、設計通りの数量の NFI 実施が困難となり、クラスター数の削減検討が必要となった際の参考資料を提供するものである。

表 21　バイオマス密度の推定と精度

SE = $S/\sqrt{n}$

SE = 68.27% confidence interval

SE*1.65 = 90% confidence interval

A

	Area (ha) (FA 2010)	# of sample (n)	Mean biomass (t dry matter/ha)	S (t dry matter/ha)	SE (+−t dry matter/ha)	SE*1.65 (+−t dry matter/ha)	Relative SE (+−%)	Relative SE*1.65 (+−%)
Evergreen (″6km*6km″ interval)	3,499,185	972	327.6	143.8	4.6	7.6	1.4	2.3
Semi evergreen (″6km*6km″ interval)	1,274,789	354	327.6	143.8	7.6	12.6	2.3	3.8
Deciduous (″6km*6km″ interval)	4,481,214	1,245	112.4	51.9	1.5	2.4	1.3	2.2
Other forest (″4km*4km″ interval)	1,108,600	693	112.4	51.9	2.0	3.3	1.8	2.9
Forest sub total	10,363,788	3,264						
Non forest (″6km*6km″ interval)	7,796,885	2,166						
Total	18,160,674	5,430						

B

	Area (ha) (FA 2010)	# of sample (n)	Mean biomass (t dry matter/ha)	S (t dry matter/ha)	SE (+−t dry matter/ha)	SE*1.65 (+−t dry matter/ha)	Relative SE (+−%)	Relative SE*1.65 (+−%)
Evergreen (″12km*12km″ interval)	3,499,185	243	327.6	143.8	9.2	15.2	2.8	4.6
Semi evergreen (″12km*12km″ interval)	1,274,789	89	327.6	143.8	15.3	25.2	4.7	7.7
Deciduous (″12km*12km″ interval)	4,481,214	311	112.4	51.9	2.9	4.9	2.6	4.3
Other forest (″8km*8km″ interval)	1,108,600	173	112.4	51.9	3.9	6.5	3.5	5.8
Forest sub total	10,363,788	816						
Non forest (″12km*12km″ interval)	7,796,885	541						
Total	18,160,674	1,357						

③　今後の対応事項

今後カンボジア政府が対応すべき事項は以下のとおりである。

- NFI 実施計画の策定。特に、地方政府の役割など、実施体制の明確化。
- 最終的なクメール語の NFI 設計書と現地調査マニュアルに従って再度 NFI 全行程の研修を実施。
- 限定された地域での NFI の実施。現地調査だけでなく、土壌の分析並びに収集データの整理といった室内作業の検証の実施。
- 上記の限定的実施の結果に基づいた NFI 設計と現場作業マニュアルの見直し。
- 全土の NFI の実施。
- 次のサイクルの NFI 計画のための、第 1 回目の NFI の結果の分析と必要な改良。

2.2.5　土地利用被覆図作成技術強化（英文報告書第 2 章　2.2.7）

① 活動内容

近代的な衛星画像解析技術が導入され、カンボジア政府はそれを用いて、2006 年 2010 年地図を改良し、2014 年と 2016 年の土地利用被覆図を作成し、土地利用被覆変化分析を実施した。

既存の地図と地図作成手法の評価

まず既存の地図の内容は下表のとおりである。表中の 2006 年と 2010 年の地図はいずれも本プロジェクトで改良する前のものである。

表 22 カンボジアの既存図の比較

	1988 - 89	1996 - 97	2002	2006（改良前）	2010（改良前）
地図作成機関	Mekong Secretariat	Mekong River Commission	Forestry Administration	Forestry Administration	Forestry Administration
地図の種類	土地被覆	土地被覆	土地被覆	土地被覆	土地被覆
凡例	20 クラス	30 クラス	8 クラス	8 クラス	8 クラス
森林定義	樹冠率 >10% 樹高 >5m	樹冠率 >10% 樹高 >5m	樹冠率 >20% 樹高 >5m	樹冠率 >10% 樹高 >5m	樹冠率 >10% 樹高 >5m
地図作成方法	紙焼き写真を判読	紙焼き写真を判読	PC 上で判読	PC 上で判読	PC 上で判読
最少図化面積：（MMU）	1 km²	1 km²	0.50 km²	0.25 km²	0.25 km²
縮尺	1/250.000	1/250.000	1/50.000	1/50.000	1/50.000
衛星データ：	Landsat TM	Landsat TM	Landsat ETM+	Landsat ETM+ gap - filled	Landsat ETM+ gap - filled
参照データ		SPOT と空中写真	Landsat TM 2000	Landsat TM, SPOT, Quickbird	Landsat TM, SPOT, Quickbird
グランドトルース	-	-	88 サンプル	100 サンプル	サンプリング数不明

出典： Brun, S. 2009. Elaboration of Cartographic tools for reforestation, CDM and REDD project activities in Cambodia. ONF International, Paris. ※2010 については筆者が追加

次に、既存の地図の凡例の比較は下表のとおりである。

表 23　カンボジアの既存地図の凡例比較

1988-89 / MRC	1996-97 / FCMP / MRC GTZ	2002 / FA	2005-06 / FA	2010 / FA
1. Dense broad-leaved forest	11. Evergreen, high cover density	1. Evergreen forest	1. Evergreen forest	1. Evergreen forest
2. Flooded evergreen forest	12. Evergreen, medium - low cover density	2. Semi-evergreen forest	2. Semi-evergreen forest	2. Semi-evergreen forest
3. Mangrove forest	13. Evergreen mosaic	3. Deciduous forest	3. Deciduous forest	3. Deciduous forest
4. Mosaic of evergreen or deciduous forest and secondary vegetal formations	17. Mixed (evergreen and deciduous), high cover density	4. Other Forest	4. Other Forest	4. Other Forest
5. Mosaic of flooded forest, swampy vegetation fallow land	18. Mixed (evergreen and deciduous) medium. low cover density	5. Wood & Shrubland Dry	5. Wood & Shrubland Dry	5. Wood & Shrubland Dry
6. Secondary vegetal formations	19. Mixed mosaic	6. Wood & Shrubland Evergreen	6. Wood & Shrubland Evergreen	6. Wood & Shrubland Evergreen
7. Pine forest	20. Deciduous	7. Non-forest	7. Non-forest	7. Non-forest
8. Deciduous forest	22. Deciduous mosaic	8. Bamboo	8. Bamboo	8. Bamboo
9. Thickets	40. Regrowth			
10. Scrub, brushwood	41. Regrowth, inundated			
11. Grass savannah	52. Inundated			
12. Grassland susceptible to flooding	53. Mangrove			
13. Swampy vegetation	54. Plantations			
14. Paddy fields	55. Other			
15. Paddy fields with palms trees	56. Inundated mosaic			
16. Mosaic of uplands crops and secondary vegetal formations	61. Wood- and shrubland, evergreen			
17. Mosaic of field crops and fruit garden	62. Grassland			
18. Plantations (rubber)	63. Bamboo			
19. Bare land	64. Wood- and shrubland, dry			
100. Water	65. Wood- and shrubland, inundated			
	81. Cropping mosaic, cropping area <30%			
	82. Cropping mosaic, cropping area >30%			
	91. Agricultural land			
	92. Barren land			
	93. Rocks			
	94. Urban or built-over area			
	95. Water			
	97. Wetland			
	99. Clouds			

これらの表の情報も参考にしながら、既存の地図の内容を記述すると以下のとおりである。

(1) 地図作成手法

森林局は JICA 技術支援チームがカンボジア入りする 2011 年 11 月以前に 3 度、衛星画像から森林図を作成した経験を有している。図化手法は、2002 年版からは GIS ソフトを用いてコンピュースクリーン上に映した衛星画像を肉眼で判読して、デジタイズする方法であり、標準的手法である。

その精度についても、前述のようにコペンハーゲン大学の関連企業である GRAS 社の評価によれば、2010 年の地図は Overall Accuracy が 80%を越しており、REDD+に用いるデータの精度としては決して低くない。

一方において、人手不足や近代的手法への関心から、森林局はソフトウェアを用いた森林被覆解析手法の導入も希望していた。

(2) 土地利用被覆クラス

表 23 に整理されているとおり、2002 年より前の地図と 2002 年を含めた新しい地図では土地利用被覆クラスの整合性が無い。

2002 年、2006 年、2010 年の地図共に、森林は常緑林、半常緑林、落葉林、竹林そして「その他の森林」という 5 種類に分類されており、それ以外は「非森林」とひとくくりにされている。今後詳細な GHG インベントリーを行う上でも、REDD+活動計画を立てる上でも、「その他の森林」と「非森林」それぞれの細分化が必要と判断された。

土地利用被覆評価改良

上述の既存地図に関する分析に基づいて、REDD+の目的に沿った地図の仕様が以下のように決定された。

(1) 土地利用被覆クラス

土地利用被覆クラスの見直しの検討会議が何度も開かれ、REDD＋に適応したクラスが決められた。その結果を表 24 に示す。2006 年と 2010 年の地図の凡例にある「その他の森林」は９クラスに、「非森林域」は８クラスに細分された。

新たに採用された Forest Regrowth（回復しつつある森林）や、Rear Mangrove（マングローブの陸側の森林）などいくつかのクラスは、他のクラスとの判別が困難であることが予想されたが、カンボジア政府の決定により、独立したクラスとして採用することとなった。

表 24　新旧土地利用被覆クラスと IPCC 分類の比較

	旧分類クラス（旧 2006 年、2010 年地図のクラス)		新たに決定されたクラス	IPCC の分類 (6 種類)
1	Evergreen forest	1	Evergreen forest	Forest land
2	Semi-evergreen forest	2	Semi-evergreen forest	
3	Deciduous forest	3	Deciduous forest	
4	Bamboo	4	Bamboo	
5	Wood shrub dry	5	Wood shrub	Other land
6	Wood shrub evergreen			
7	Other forest	6	Mangrove forest	Forest land
		7	Rear mangrove	
		8	Rubber plantation	Cropland
		9	Flooded forest	Forest land
		10	Forest regrowth	
		11	Pine tree	
		12	Pine plantation	
		13	Oil palm	Crop land
		14	Tree plantation	Forest land
8	Non-forest	15	Paddy field	Cropland
		16	Crop Land	
		17	Grassland	Grassland
		18	Built-up area	Settlement
		19	Village	
		20	Rock	Other land
		21	Sand	
		22	Water	Wetland

(2) GHG インベントリーと REL/RL 計算用地図の選定

REL/RL の計算には最低限 2 期間の森林炭素の排出吸収データが必要であり、それには最低限 3 時期の地図が必要である。2002 年より以前の地図は凡例が異なることから除外、2002 年の地図は MMU が 0.5km^{2}と大きいことと、精度検証を受けていないために除外し、2006 年と 2010 年の地図を活用することとした。3 時期目の地図としては、新たに 2014 年の地図を作成することとなった。また、その後 2015 年には、参照排出レベルの信頼度を上げるために 2016 年の地図の作成が決定された。

(3) 地図作成技術の改良

従来の肉眼判読による主観的な土地利用被覆判別の度合いを減らすために、また、地図作成の経験が浅く、土地利用被覆クラスの境界線描画技術が不十分な若手職員の作業を支援するために、森林局は「オブジェクト分類」手法の導入を決め、日本政府の無償資金協力により「eCognition」というソフトウェアが導入された。

FAO はブラジルの INPE が作成した森林図作成システムである Terra Amazon の導入を森林局に提案し、GRAS は市販のソフトである IDRISI Taiga を用いた炭素量調査のトレーニングを行うなど、森林局に対して複数の異なる手法が提案されていたが、TerraAmazon や IDRISI Taiga は導入されなかった。

eCognition というソフトウェアは 2014 年と 2016 年の新規地図作成に使われた他、2006 年と 2010 年の地図の「その他の森林」と「非森林域」の細分化にも用いられた。このような新しいソフトウェアに加えて、品質管理のために論理チェック手法も導入され、例えば 2006 年に森林、2010 年に非森林、2014 年に森林といった通常は起こりにくい変化を示している区域の抽出に使われた。論理チェックで抽出された地域は、再度衛星画像に照らして正否が確認された。

表 25 は、2006 年（改良後）、2010 年（改良後）、2014 年そして 2016 年の土地利用被覆図の内容と作成方法の対比表である。

表 25　4 種類の地図の内容の比較

	2016	2014	2010 改良後	2006 改良後
土地利用被覆クラス	表 24 に示された新しい土地被覆分類クラス（22 分類）			
森林定義	最少面積:　0.5ha 樹高：　成長後に 5 メートル以上 樹冠率：　10%以上			
地図作成手法	● 衛星画像のセグメンテーションと目視判読。 ● 主成分分析（PCA）手法を用いて、2014 年の地図から変化した可能性がある部分を抽出。 ● 最少図化面積は 5ha	● 衛星画像のセグメンテーションと目視判読。 ● 最少図化面積は 5ha	● 「その他の森林」と「非森林域」の細分化にはセグメンテーション手法を使用し、生成されたポリゴンの土地利用被覆クラスを肉眼で判別 ● 「その他の森林」と「非森林域」の最少図化面積は 5ha。 ● 「その他の森林」以外の森林は原図の最少図化面積は 25ha であったが、改良版では 5ha の最少図化面	

			積基準で見直して編集。	
使用した人工衛星画像	LANDSAT 8		LANDSAT 5	LANDSAT 7 gap-filled

(4) 2006 年、2010 年、2014 年、2016 年地図の作成

異なる時期の土地利用被覆図間の整合性を確保するためには、1 時期について信頼性の高い地図を作成し、それ以後はその地図からの変化を抽出する手法が適している。しかしながらカンボジアの場合、当初は 2015 年末までに UNFCCC に参照排出レベルを提出するという目標があり、一方で 2006 年と 2010 年の地図共に改良が必要なため、その完成を待ってから 2010 年地図を元にして 2014 年地図を作成する時間的余裕はなかった。このため、2014 年地図は 2010 年地図からの変化抽出ではなく、新たな地図として作成された。

2006 年と 2010 年地図の改良と 2014 年の新規地図作成は、2013 年に開始された。3 時期の地図原稿が完成した後、森林局により論理チェックや目視による整合性のチェックが行われ、必要な修正が加えられた。

2016 年地図の作成は 2015 年に開始された。土地利用被覆の変化が起きた可能性が高い地域の主成分分析による抽出技術が導入され、原稿図については、2014 年版地図と同様に、論理チェックと目視による点検が行われた。2016 年地図の作成フローを図 18 に示す。今後しばらくはこの手法が基本になると考えられる。

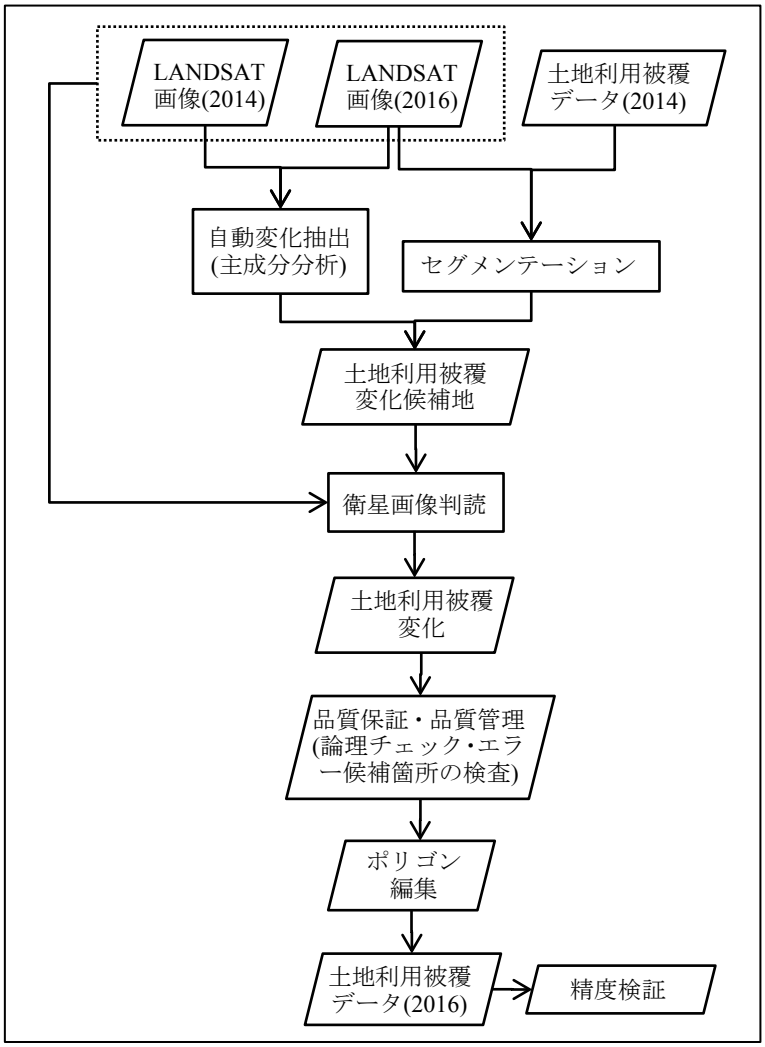


図 18　2016 年の地図作成フロー

図 19、図 20、図 21 そして図 22 は 4 時期の地図の縮小版である。

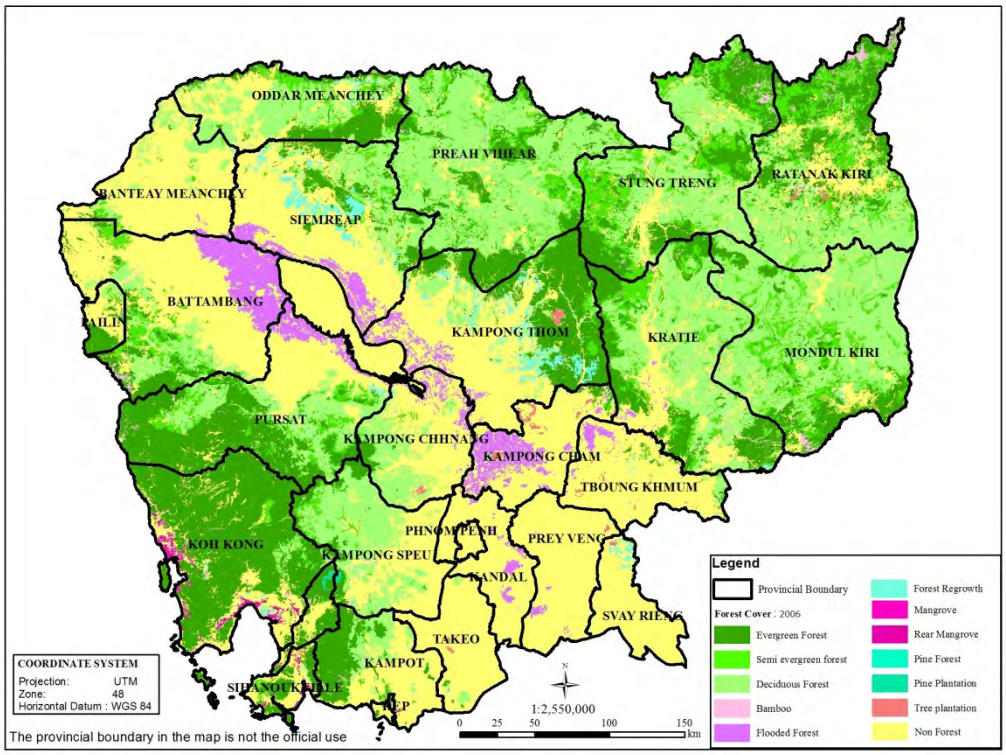


図 19　2006 年の土地利用被覆図（改良後）

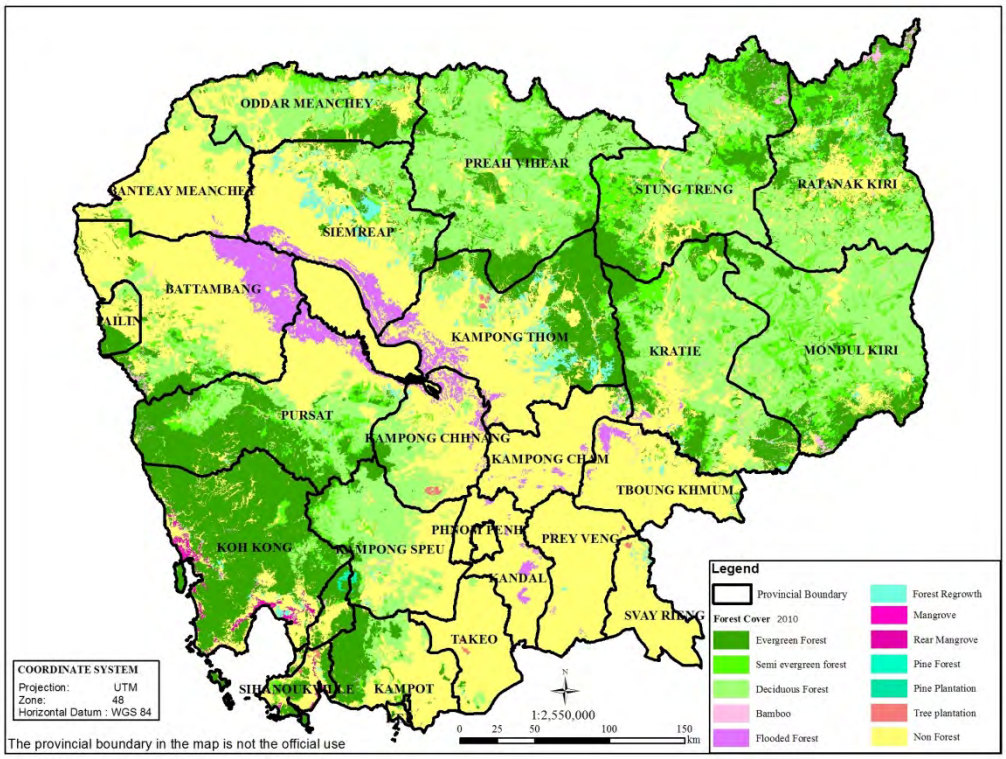


図 20　2010 年の土地利用被覆図（改良後）

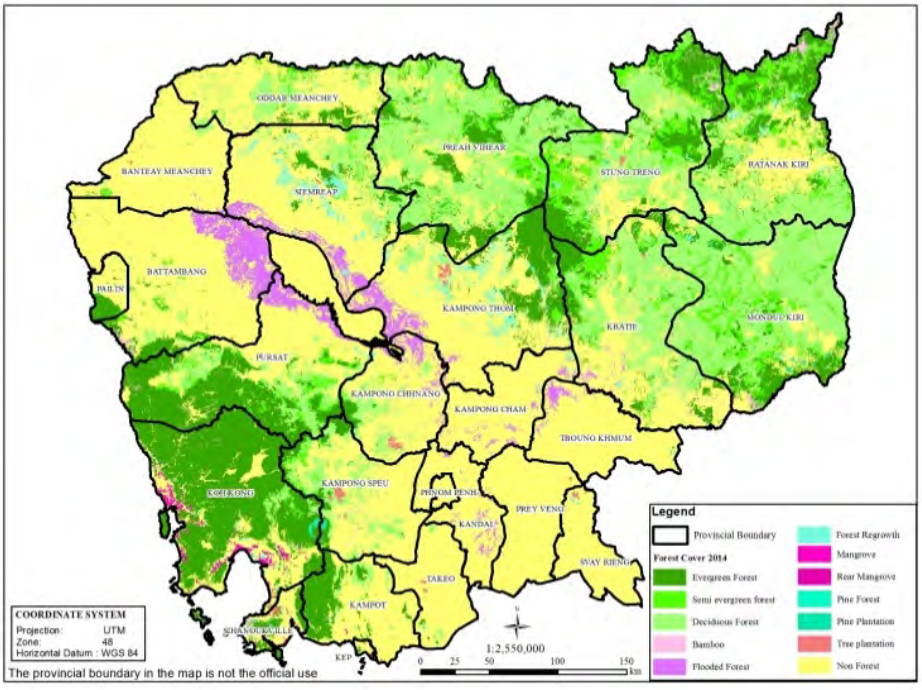


図 21　2014 年の土地利用被覆図

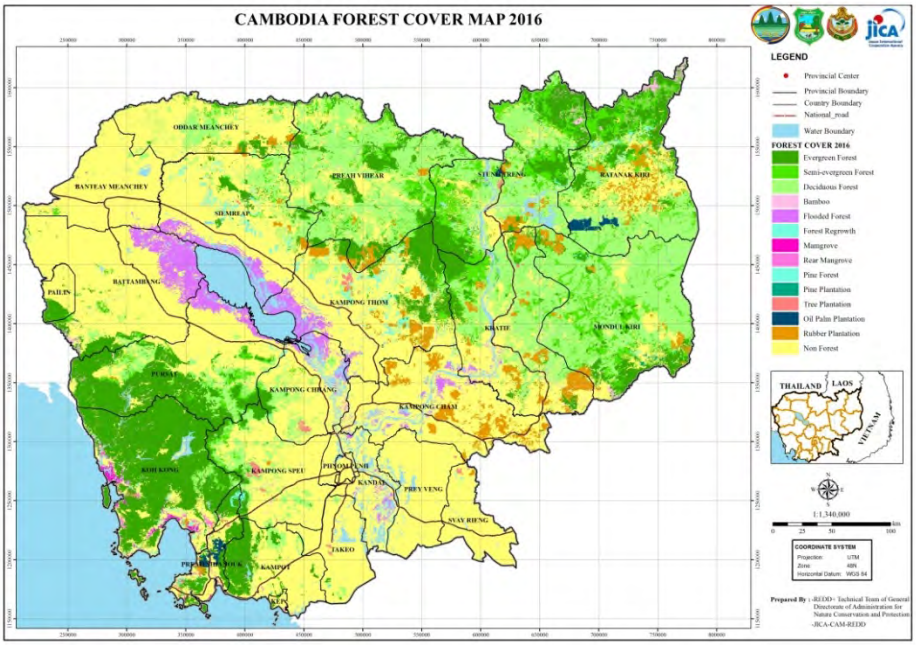


図 22　2016 年の土地利用被覆図

2006 年の地図の精度は、GRAS の精度検証の結果をそのまま採用し、2010 年 2014 年そして 2016 年の地図の精度検証は、カンボジア政府が実施した。

各地図の Overall accuracy は次のとおりである。

2006 年地図　71%
2010 年地図: 73.97%
2014 年地図 82.17%
2016 年地図: 87.48%

2014 年の地図まで森林局は 4 年間隔で地図を作成していたが本プロジェクトによる新技術の導入で、地図作成に係る時間が大幅に減ることが確認された。今後 2 年間隔での地図作成は可能である。

② JICA 技術支援チームの役割

まず JICA 技術支援チームは、2006 年、2010 年地図の改良と、2014 年と 2016 年地図作成の全てについて、その手法を考案し、最終的な手法は MRV/REL 技術チームおよび UN-REDD の専門家との協議により決定された。

JICA 技術支援チームは、2010 年、2014 年そして 2016 年地図の作成と精度検証でも、森林局（2016 年 10 月からは環境省）を支援した。UN-REDD の専門家は主に 2006 年地図の改良を支援した。

2010 年地図の精度検証には、無償資金協力で調達された日本の人工衛星のセンサーである AVNIR-2 の画像が、2016 年地図の精度検証には、JICA が調達した Rapid Eye 画像が使用された。

なお、日本の森林研究・整備機構も、カンボジア政府森林局（2016 年中盤からは環境省）の若手職員に対して地上での森林調査と画像判読、そして eCognition ソフトの使用などについてカンボジア国内あるいは日本国内で技術指導を行い、これら職員の能力向上に貢献した。

③ 今後の活動

森林劣化の判別の手法開発については、FCPF による支援の中で研究が行われることになっている。一方、判別が容易でない土地利用被覆クラスのグループ化も検討すべきと考える。

また、本プロジェクトが開始された時には無かった、Google Earth Engine のような衛星データのアーカイブサイトや、クラウド型の衛星画像処理サービスが登場してきており、今後はこうしたサービスの活用検討もカンボジア政府の課題のひとつになる。

2.2.6 GHG インベントリーシステム（英文報告書 2 章　2.2.10）

① 活動内容

IPCC ガイドラインの分析と、GHG インベントリー作成手法の研修や比較検討が行われ、カンボジアは IPCC ガイドライン 2006 を採用することが決定された。

カンボジアは最初の国別報告（NC）を作成した時に GHG インベントリーは実施しているが、その知識と経験を有する職員はほとんどいない状況であった。このため、MRV/REL 技術チームは、IPCC ガイドラインの内容把握から、GHG インベントリーに関する活動を開始し、FAO の専門家による GHG インベントリー作成ツールの実習も行われた。

こうした検討作業を続けた結果、IPCC のガイドラインとしては、2006 年版を採用することが決定された。

② JICA 技術支援チームの役割

JICA 技術支援チームは、MRV/REL 技術チームに IPCC ガイドラインの解説書を提供し、カンボジア側の理解を深めた。また、ガイドラインに沿ったＧＨＧインベントリーで求められているデータの種類を明らかにし、計算例を示した。

③ 今後の活動

現在カンボジア政府は、最初の隔年更新報告（BUR）の作成に取り掛かっている。この BUR 用の GHG インベントリー作成が直近の業務となる。重要な課題としては、UNFCCC に提出した森林参照レベルの内容との整合性の確保がある。

2.2.7 参照排出レベル設定（英文報告書第 2 章 2.2.9）

① 活動内容

参照排出レベルとその算出根拠を示した書類は 2016 年 11 月に UNFCCC に提出され、2017 年 3 月から UNFCCC による審査を受けている。この審査は 2017 年末までには終了の予定である。

現時点での FRL 書類は別添資料 4 として本報告書に添付した。

森林参照レベルの設定は、REDD+の仕組みの中で成果払いを受けるための重要な条件である。カンボジアは当初は 2016 年 1 月に参照排出レベルを UNFCCC に提出することを目標に作業を行うこととし、その方針に沿って土地利用被覆図の整備等を開始した。

森林参照レベルの仕様は、MRV/REL 技術チームにて検討され、2015 年の COP21 まで

には UNFCCC 提出用の書類がほぼ出来上がっていたが、土地利用被覆変化抽出に用いた2014 年の地図のカンボジア政府による承認が降りていなかったため、正式な提出は見合わせ、1 年遅れの 2016 年 11 月の COP22 の際に提出された。

UNFCCC の評価は 2017 年 3 月から開始された。評価チームからは FRL に関する質問票の送付があり、カンボジア政府はそれに対する回答を作成して返信した上で電話会議が開かれ質疑応答が行われた。その後、評価チームの報告書の原稿の送付があり、その報告書原稿に記載されている提案に基づき、FRL の値の微調整や記述内容の改良が行われ、改定版 FRL が提出された。この改訂版 FRL を元にした最終報告書原稿が 8 月に評価チームからカンボジア政府に送付され、それに対するコメントが 10 月末までに評価チームに送り返された。評価チームはそのコメントを参照して、最終的な報告書を 2017 年末頃までに作成することになっている。

カンボジアの FRL の内容は以下のとおりである。

（1）　スケール：　国

（2）　活動：土地利用被覆変化（森林増加および減少）と、森林クラス内のクラス変更による劣化

森林劣化は、森林クラス内での他のクラスへの変更以外、的確かつ経済的に捉える技術がまだ無いため、計測対象として含まれていない。

（3）　炭素プール：地上バイオマスと地下バイオマス

枯死木、リター（落葉、落枝）、土壌についてはカンボジア国内のデータが無いため、参照排出レベルの計算からは除外してある。温室効果ガスについては炭酸ガスだけを対象とした。

（4）　温室効果ガス：　二酸化炭素

（5）　森林参照レベルに用いた森林定義と森林タイプ

森林局が用いてきた森林管理のための定義は国家森林計画に定められている。それによると森林には、油ヤシとゴムのプランテーションや多年生作物が含まれている。これに対し、REDD+のためにカンボジア政府が採用した定義は以下のとおりである。

- REDD+プログラムにおける森林とは、樹高 5m 以上、面積 0.5ha 以上そして樹冠率が 10%以上の自然あるいは人工の植物に覆われた陸地あるいは湿地である。
- ゴムの植林地、油ヤシの植林地そして多年生作物は森林から除外する。

（6）　参照期間

UNFCCC は森林参照レベルの設定には過去のデータを用いることを求めているが、参照期間については定めがない。カンボジアは 1965 年から森林被覆についてのデータを持っているが 2002 年より以前に作成された地図は、土地利用被覆クラスの統一性が

無く、2002 年の地図は精度検証を受けていなかったことから信頼度が不明なため、2006 年以降の地図を使うことになった。このため、参照期間は 2006 年から 2014 年の 8 年となった。

（7）　　森林参照レベル設定のアプローチ

カンボジアは、2006 年から 2014 年の 8 年間の年平均排出量を用いた。その理由は、排出・吸収データは 2006 年から 2010 年、2010 年から 2014 年の 2 時期のものしかなく、高度な分析はできないことである。

（8）　　計算方法

年平均の炭酸ガス排出・吸収は以下の式により計算された。

$$\Delta C_B = \frac{(Ct_2 - Ct_1)}{(t_2 - t_1)}$$

$$\Delta CO_2 = \Delta C_B \times 44/12$$

ΔC_B = 同じ森林クラスに蓄積されている、バイオマスの年平均変化。単位はトン。
C t_2 = t2 時点での各土地利用被覆クラスのバイオマス中の炭素。単位はトン。
C t_1 = t1 時点での各土地利用被覆クラスのバイオマス中の炭素。単位はトン。
Ct (排出) =　活動度データ×排出係数
44/12: 二酸化炭素と炭素の重量比　(出典：IPCC ガイドライン, 2006)

土地利用被覆変化の抽出に用いた地図は 2006 年、2010 年、2014 年の 3 時期。

（9）　　平均的炭素蓄積量

炭酸ガスの排出・吸収は、各時期の各土地利用被覆クラスごとの炭素蓄積量の計算により得られる。カンボジアの最初の森林参照レベルでは、非森林の炭素ストックはゼロとした。信頼するに足るデータが無いためである。

カンボジアでは国家森林インベネントリーが実施されていないために、地上バイオマスの量は、さまざまな資料に基づいて推定した。表 26 がその推定値である。

表 26　森林タイプごとの地上バイオマス（ton ha-1）の推定値

森林タイプ	地上バイオマス トン ha-1	C トン ha-1*	CO_2 トン ha-1**
Evergreen forest	163	76.61	280.90
Semi-evergreen	243	114.21	418.77
Deciduous	85	39.95	146.48
Pine forest	100	47.00	172.33
Bamboo	0	0.00	0
Mangrove	150	70.50	258.50
Rear Mangrove	165	77.55	284.35
Inundated	70	32.90	120.63
Forest regrowth	75	35.25	129.25
Pine plantation	100	47.00	172.33

*バイオマスから炭素への換算には、IPCC ガイドライン 2006 に掲載されている値である 0.47 (ton C /ton d.m.)を用いた。

**炭素と二酸化炭素の重量比は 44/12

② JICA 技術支援チームの役割

カンボジアでの活動開始から間もなく、参照排出レベルに関する 2 種類のワーキングペーパーを作成し、2012 年 2 月に森林局に提出した。参照排出レベルに関する理解を深めることが目的である。

ワーキングペーパー No.1	Simulation / Trial Calculation of RELs (Reference Emission Levels) of Cambodia with Different Scale Approach
ワーキングペーパー No.2	Trial Calculation of Historical Trend of Annual CO_2 Emissions/Removals in order to Understand Cambodian Nationwide RELs (Reference Emission Levels)

2014 年 12 月には、最初の森林参照レベルの計算の原稿を作成し、MRV/REL 技術チームに提供した。

2015 年 3 月には、UNFCCC に提出する森林参照レベル文書の土台としての“Calculation of Initial Reference Emission Level for Cambodia (Draft)” を作成。この内容の検討には、UN-REDD 専門家および FAO 本部の専門家が参加した。

JICA 技術支援チームは、カンボジア国内あるいは近隣諸国における地上バイオマスに関する技術論文等を収集し、カンボジアの各森林クラスについて地上バイオマス値の値を可能な限り抽出した。その上で、常緑林、混交林そして落葉林に関しては、FAO がカンボジ

ア国内で過去に実施された森林調査結果を可能な範囲で収集、分析して選定した地上バイオマス値との比較を行い、初回の FRL 計算に用いる地上バイオマス値として妥当と思われる値を選定した。この 3 種類の森林以外については、IPCC ガイドラインや収集した技術論文の中から妥当と思われる地上バイオマス値を選定した。

次に、上記の地上バイオマス値と、森林局が 2006 年、2010 年、2014 年の地図から作成した、2006 年から 2010 年、2010 年から 2014 年の間の土地利用被覆変化データを用いて、この 2 期間の排出・吸収量を算出する方法につきカンボジアの MRV/REL 技術チームを指導した。

森林参照レベル文書が UNFCCC に提出された 2016 年 11 月以降、JICA 技術支援チームは、UNFCCC による評価に関してカンボジア政府を支援してきた。具体的には、評価チームからの質問票への回答作成、評価報告書原稿へのコメント作成などの支援である。

③　今後の活動

カンボジアの森林参照レベルには以下のような改良が必要である。

- 活動度データの数を増やして森林参照レベルの信頼性を上げるために、土地利用被覆図を作成する。
- 各森林クラスの炭素蓄積量推定値を改良するために、国家森林インベントリーを実施する。
- 炭素蓄積量推定値を改良するために、木材密度のデータを増やしあるいは改良する。
- 炭素蓄積量推定値を改良するために、主な樹種のアロメトリー式を開発する。
- 森林参照レベルの有効期間を決定する。

(1) 活動度データの数を増やして森林参照レベルの信頼性を上げるために、土地利用被覆図を作成する。

現時点のカンボジアの森林参照レベルの計算には、3 時期の地図データしか使われていない。将来の土地利用被覆の正確な予測をするためには、地図の数を増やす必要がある。カンボジアの国家 REDD+戦略の原稿では、地図更新サイクルを 2 年にすることとなっている。

(2) 各森林クラスの炭素蓄積量推定値を改良するために、国家森林インベントリーを実施する。

現在のカンボジアの森林参照排出レベルの計算に用いた各森林クラスごとの平均的な炭素蓄積量の元データの大部分は、カンボジア国内で過去に実施された森林インベントリー調査結果である。しかしながらカンボジアでは国家森林インベントリーは未だ実施されておらず、既存の森林インベントリー調査はカンボジアの森林を全て網羅

しているわけではなく、マングローブについてはカンボジア国内のデータは存在しない。このため、一度は全土の森林インベントリー調査を実施する必要がある。

(3) 炭素蓄積量推定値を改良するために、木材密度のデータ量を増加または改良する。

木材密度のデータは樹木のバイオマス量の算定に必要である(Chave *et al.*, 2014)[11]。また密度測定に必要な機材の不足とそれに係るコストが、密度測定実施の障害となっているが、樹種レベルの木材密度データは、バイオマスを推定するためには必要なデータである。(Fayolle *et al.*, 2013)[12]. このため、木材密度データを増やすことにより、森林参照レベルの信頼度も上げることができる。

(4) 炭素蓄積量推定値を改良するために、主な樹種のアロメトリー式を開発する。

地上バイオマスの乾燥重量を胸高直径や樹高など測りやすい要素を用いて計算するためにアロメトリー式が用いられる。

カンボジアの森林参照レベルの開発では、既存の森林タイプ毎のアロメトリー式が用いられた。しかしながら、本来アロメトリー式は樹種ごとに異なる。このため、国家森林インベントリーが実施された後に、その収集データから、主な樹種についてのアロメトリー式を開発する必要がある。

(5) 森林参照レベルの有効期間を決定する。

森林参照レベルには有効期間がある。有効期間の選定は排出量削減量に影響を与えるが、有効期間については、MRV/REL 技術チームの中でのさらなる検討が必要である。

2.2.8 国家 REDD+戦略策定（英文報告書第 2 章 2.2.2）

① 活動内容

国家 REDD+戦略の原稿が完成し、カンボジア政府による承認プロセスにある。.

ポーランドのワルシャワで 2013 年 11 月に開催された COP19 にて、国家 REDD+戦略（NRS）の策定は、成果支払いを求めるための重要条件のひとつと規定された。カンボジ

11 “Improved allometric models to estimate the aboveground biomass of tropical trees” Global Change Biology (2014) 20, 3177-3190

12 Fayolle AD, Doucet JL, Gillet JF, Nils Bourland, Philippe Lejeune, 2013. Tree allometry in Central Africa: testing the validity of pantropical multi-species allometric equations for estimating biomass and carbon stocks. Forest Ecology and Management:305:29-37

アは NRS 策定作業を 2014 年に開始した。

2015 年 5 月には、関係者からの意見を聴くための最初のコンサルテーション会議が開催された。その後、戦略の内容を決めるために数多くの会議が開かれ、2015 年 11 月までに NRS の英文原稿が策定された。戦略は、NFMS、森林参照レベル等の開発と相互に影響を与えながら策定された。2017 年 5 月時点での NRS 原稿の要旨は以下のとおりである。(別添資料 5 参照)

ビジョン

自然資源と林地の管理、生物多様性保全と持続的開発の改善を通じて、カンボジアと地球規模の気候変動抑制に貢献する。

ミッション

自然資源と林地の管理、および生物多様性保全をさらに進めるための政策、法律そして規則の効果的な実施を可能にするために、国と準国の組織の機能と能力を強化する。

目標

持続的な管理、自然資源の保全を行いながら、森林減少と劣化を減らし、かつ貧困撲滅に貢献する。

スケール

NRS では土地利用変化による森林減少の把握を優先しつつ、森林劣化抽出の能力を養成する。カンボジアは、UNFCCC の成果払いメカニズムに従って REDD+を国レベルで実施する。一方、特定の条件下での準国あるいはボランタリー市場ベースの REDD+プロジェクトクトの実施も検討する。

マイルストーンと結果

2026 年までに 2006 年から 2014 年の FRL 期間中の年間森林減少率を半減させることである。削減された排出量は成果支払いの対象となる。

NRS はまた、2017 年から 2026 年の間を 2 つのフェーズに分け、個々のフェーズで実施すべき活動について述べている。キーワードには筆者が下線を引いた。

NRS フェーズ I (2017-2021)

- アクションプラン の策定
- NRS 実施のための 組織体制 構築。
- NFP、NPASMP、SPFF や、ELC と SLC に関する政令といった森林管理のための既存の枠組みのきちんとした実施を通じて森林減少と劣化の 原因への対策を講じる 。こうした枠組みには、森林法の執行強化、土地所有権の保全、そして村落をベースとした森林資源管理の実施に関連した政策や方策

も含まれる。

- 森林に関する諸問題に対処するための成果支払いとは別の、前倒しの資金調達手法の動員を優先させ、同時に現場での REDD+活動の実施と成果実現能力の強化を行う。
- 現在の FRL と NFMS の改良。
- ワルシャワ枠組みの要求事項に完全対応するための SIS の構築。
- 教訓と課題を明らかにし、次のフェーズでこれらに対処することを目的とした NRS の中間評価。

NRS フェーズ II (2022-2026)

- REDD+準備プロセスから実施段階への移行の完了。
- 測れる成果達成を優先。
- フェーズ I の評価の レビュー。
- NRS の効果の指標となる、2016 年、2018 年、2020 年の森林と土地被覆変化の評価。
- WEB プラットフォームや他のコミュニケーション手法を通じた、情報、データ、そして FRL、NFMS、調査分析業務の結果を 公開するための実用的なメカニズム の設立。
- FRL と NFMS の改良につなげるための データ改良。
- フェーズ II 期間中の、成果支払いを目的とした排出削減報告の提出。
- フェーズ II 期間の主要なマイルストーンは、森林減少と劣化の原因に対応するための政策と方策の効果と効率をチェックするための、正確な森林モニタリングメカニズムの構築。
- さらに、UNFCCC のセーフガードに関する要求に対応するために、SIS の を継続的なモニターと化。

② JICA 技術支援チームの役割

JICA 技術支援チームは、まず戦略で書くべき内容を検討するメンバーとして選ばれ、UNDP、FAO の専門家と共にカンボジア政府を支援した。次に、戦略の NFMS と FRL 部分について、現状と方向性そして今後の開発・改良予定を記述した原稿を作成し、戦略策定を担当するカンボジア政府職員のチームに提供した。

③ 今後の活動

カンボジア政府の森林・環境セクターの組織・制度改編の影響で、REDD+の実際の活動をどの組織が行うかについては NRS では十分に記述されていない。

これから、森林減少・劣化を抑制する具体的な活動内容が固まると同時に、カンボジア政府内部での REDD+活動に関する職務分掌を明らかにする必要がある。特に地方政府の役割と責任の明確化は、REDD+活動の成否を決める重要な事項である。

また、今後、UNFCCC の枠組みで以外の小規模な REDD+プロジェクトが計画される場

合には、そのプロジェクトにどのような FRL を適用するかの検討、決定が必要となる。

2.2.9　　デモンストレーション活動（英文報告書 2 章　2.2.3）

①　活動内容

JICA 技術支援チームが活動を開始した 2011 年 11 月時点で、森林局はカンボジア北部の Oddar Meanchey 州の Community Forest での REDD+案件と、モンドリキリ州の Seima 保護林地区での REDD+案件を開始していた。

Oddar Meanchey の REDD+案件を支援したのは、米国の Terra Global Capital であり、米国の NGO の PACT が現地での活動を実施していた。このプロジェクトの有効化審査はすでに済んでおり、検証業務が米国の有効化審査・検証企業である、SCS Global によって実施された。

Seima 保護林の REDD+プロジェクトは、米国の NGO である Wildlife Conservation Society (WCS)が森林局を支援しており、こちらの有効化審査も SCS Global 社によって実施された。

Seima 保護林の REDD+プロジェクトの対象面積は 180,513 ha、2010 年からの 10 年間の排出削減量は計 1400 万トン CO_2 とされており、その炭素クレジットの一部がすでに販売されている。

②　JICA 技術支援チームの役割

Oddar Meanchey のプロジェクトの検証と、Seima のプロジェクトの有効化審査業務の発注監理業務を担当した。

第3章 プロジェクト実施運営上の課題・工夫・教訓

3.1 課題１ 複数のドナーによる支援

実施方針で述べたとおり、本業務では他の開発パートナー特に UN-REDD のメンバーである FAO と UNDP との連携が重要であった。REDD+準備プロセスを支援している主要な開発パートナーが JICA,FAO、UNDP であり、お互いの活動が影響を与え合うからである。

国連の機関である FAO および UNDP と JICA の業務実施方法を比較すると以下のようになる。

比較内容	JICA	FAO/UNDP
専門家の投入形態	● コンサルタント企業等ひとつの組織に一括発注。このため、活動全体の統一が取れている。 ● 業務実施契約部分では、長期専門家はおらず、業務従事者は短期専門家として現地業務に従事。このため、カンボジア国内で開催される全ての会議、WS 等に出席できるわけではない。	● FAO が MRV/REL 分野担当の専門家１名を長期専門家としてカンボジア国内に配置。 ● MRV/REL の個々の分野については、ひとつの組織への一括発注ではなく、分野毎の公募により専門家を雇用。このため、専門家間の連携は取りにくい。
業務実施形態	● カンボジア政府職員を雇用することはない。 ● 彼らが自前の予算にて活動し、JICA 専門家はそれを技術的に支援する形態である。	● 人件費以外の実費を森林局に支払い、地図作成などの実施を支援。 ● また、カンボジア政府の職員をローカルコンサルタントとして期間限定で雇用。
業務実施計画	● ワークフローで明らかにする活動項目を元にした計画であり、活動項目間の関係が分かり易い。	● どちらかと言えば予算項目に対する実施計画であるため、活動項目間の関係が分かり難い。

両者の活動計画は基本的には、カンボジア政府の REDD＋ロードマップに沿ったものであるが、細かい活動項目の内容や名称は異なり、また上述のように、専門家の投入形態と業務実施形態が異なるため、常に両者の活動の調整が必要となった。

3.1.1 工夫

両者の活動内容の調整を容易にするために、両者の活動内容を関連付ける対比表や、両者の活動計画を統合するスケジュールの作成を行った。また特に FAO との意思疎通を良くするため、以下のような対応を採った。

- 頻繁な情報交換
- ワーキングペーパーや技術メモなどの提供
- ワークショップやセミナーの共同開催
- FAO 専門家のアサインメントと JICA 専門家のアサインメント時期の調整

3.1.2 教訓

統合されたスケジュールの作成は、両者の業務内容調整に一定の効果があったが、両者の活動項目名をなるべく尊重し削除しないで組み合わせたために、活動項目数が大変に多い複雑なものとなった。今後複数の開発パートナーが同時に支援をする形態になった場合には、同じ活動項目名を用いた統一計画書の策定に、活動開始早々に十分時間を割く必要がある。

一方、FAO との協働から得られる知見は、JICA 技術支援チームの視野の拡大に貢献した。

また、１，２週間の研修を技術移転の主要手段とする欧米や国連の開発パートナーに対して、JICA 技術支援チームは実際の業務実施に寄り添ってカンボジア側の疑問を解消し技術レベルを上げていく OJT 方式の支援に力を入れたが、この支援方法はカンボジア政府から高い評価を受けた。

3.2 課題２　森林環境セクターの省庁再編

2015 年頃から、森林の管理を森林局から環境省に移管する動きがカンボジア政府内部で出始め、森林局次長で、かつカンボジア REDD+タスクフォースの議長が、環境省の自然保全保護区総局長として転出し、2016 年 10 月には、森林局で土地利用被覆図作成を担当してきた職員の大半が、環境省自然保全保護総局に移籍した。こうした一連の動きと共に、REDD+に関する活動の権限も森林局から環境省に移されたため、カンボジアの REDD+活動に大きな混乱が発生した。

3.2.1 対応

JICA 技術支援チームは、カンボジア政府の REDD+ロードマップ実施支援という目的の下、森林局あるいは環境省だけを支援しているわけではなくカンボジア REDD+タスクフォースを支援していることを明確にし、両機関への支援を続けた。また、両機関に供与された機材の活用は、複数の省庁職員が構成員である MRV/REL 技術チームが責任を持って行うルールを設立することによって担保した。

3.2.2 教訓

JICA 技術支援チームは REDD+タスクフォースへの支援を目的とすることを業務開始当初から明らかにしていたことは、この混乱の影響の拡大防止に役立たった。

3.3 REDD＋という新しい仕組みに関する支援

本業務が開始された 2011 年 11 月時点では、UNFCCC において REDD+という仕組みの大枠は決まっていたものの、その詳細については未だ十分議論されておらず、成果支払い請求の条件が明確になったのは、2013 年にワルシャワで開催された COP19 での決定であった。

こうした状況では、各国の MRV/REL の内容については自由度が高い一方、不透明な状況下でカンボジアの将来に影響を与える仕組みを設定しなければいけないという課題が生じることとなった。また、COP での議決内容も、それだけ読んでいてはなかなか真意が汲み取れない外交的な文書であり、その解釈には注意が必要であった。

3.3.1 工夫

常に更新される REDD+に関する情報に対応するために、日本の専門家からの情報収集だけでなく、FAO や UNDP 専門家との日々の情報交換、意見交換を行った。

3.3.2 教訓

様々な国で REDD+業務に従事している JICA 専門家との意見交換の場が JICA により設けられていたため、そこで REDD+に関する他国の情報を得ることができたが、支援委員会などを正式に設置し、そこで各国での JICA の支援内容について議論できれば、日本としての統一感を持った REDD+支援をより鮮明に打ち出すことができた可能性がある。

第4章 プロジェクト目標の達成度

プロジェクト目標 REDD+の戦略と政策の実施が円滑に行われるように関係者の能力が強化される

本プロジェクトが開始された 2011 年 11 月から本報告書作成時の 2017 年 10 月までの 6 年間に、JICA を初めとする開発パートナーの支援を受けながらカンボジア政府が策定した REDD+に関する重要な文書・計画は以下のとおりである。

- 国家 REDD+戦略
- 森林参照レベル
- 国家森林モニタリングシステム（設計書）
- セーフガード情報システム（基本設計終了）

こうした計画や仕組みの構築を経験することにより、カンボジア政府の「REDD+の戦略と政策の実施が円滑に行われるための関係者の能力」は飛躍的に強化されたと言える。実際に国連やカンボジア政府に提出する公式文書の作成では、カンボジア政府担当者は単なる研修とは異なり、真剣に向き合わざるを得ないからである。

第5章 上位目標達成に向けての提言

上位目標 REDD+実施の経験に基づき、気候変動の緩和策として持続可能な森林経営が推進される。

森林減少・劣化の緩和は「カ」国政府の重要課題の一つとなっており、国家 REDD+戦略の中でも、森林減少と劣化の原因分析に基づいた施策が提示されている。カンボジア政府職員は、FRL 構築や NRS 策定を通じて REDD+の仕組みのみならず、森林減少・劣化の原因まで掘り下げて考えることができた。

ただし、NRS での森林減少・劣化原因分析は国レベルのものである。こうした原因は、その種類によっては地域ごとに異なるため、さらに分析を進めて各地域にあった抑制策を選定する必要がある。また、REDD+活動を同時に全国で実施することは財政的にも人的資源の観点からも無理があるので、まずは、REDD+活動に理解がある地方自治体を選定し、その自治体あるいは、その自治体を含む地域で、森林減少と劣化を抑制する施策を実施するのが現実的対応と考えられる。これは REDD+のフェーズ II の活動であるが、抑制策の実施により、持続的な森林経営についての実践的な知見が得られるため、その知見に基づきカンボジアでの森林経営がさらに改善され、気候変動の緩和に貢献すると考えられる。

別添資料 1

最終セミナー配布資料

Toward Phase II of REDD+

Achievements and Next Step

REDD+ of Cambodia

"Reducing Emission from Deforestation and Forest Degradation and the role of conservation, sustainable management of forests, and enhancement of forest carbon stocks in developing countries" (REDD+) is a mechanism to provide finance to activities to reduce greenhouse gases emitted by deforestation and forest degradation. Value of forest resources has long since been recognized by the Royal Government of Cambodian and sustainable use of natural resources is listed as one of the strategies in "Rectangular Strategy for Growth, Employment, Equity and Efficiency" of Cambodia.

Cambodia considers REDD+ as an effective measure to reduce deforestation and forest degradation and in 2009 a REDD+ Roadmap, which states actions to be taken to become REDD+ ready, was completed. In order to implement actions identified in the roadmap, multiple development partners including JICA pledged support.

In the past 6 years, Cambodia made a great progress in its REDD+ activities including submission of Forest Reference Level document to the United Nations Framework Convention on Climate Change (UNFCCC), preparation of a National REDD+ Strategy (NRS), design of a National Forest Monitoring System (NFMS) and its components, improvement in land use/cover assessment techniques, and implementation of REDD+ demonstration projects. Prototype design of a Safeguard Information System (SIS) was also worked out.

REDD+ activities is usually divided into three phases. Phase I is REDD+ readiness phase, Phase II is demonstration or implementation phase and Phase III is for full implementation of REDD+ for results-based payment. Cambodia is now in the transition stage from Phase I to Phase II although some parts of activities of Phase II have already been implemented.

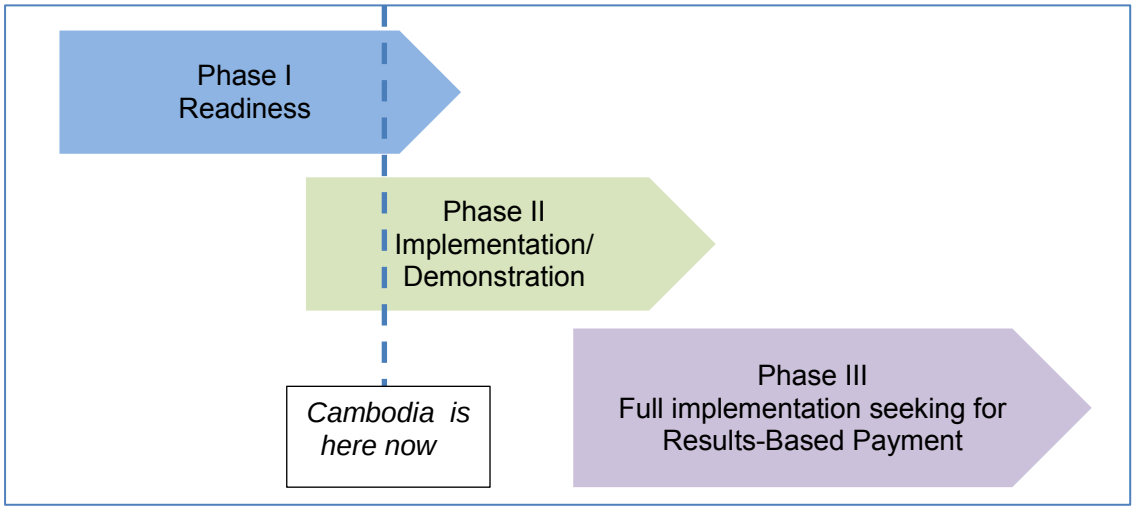
This short paper summarizes achievements made by Cambodia on REDD+ readiness activities as well as future actions to be taken.

October 17, 2017

MRV/REL Technical Team
Cambodia REDD+ Taskforce

REDD+ Phases

Cambodia is in the transition from Phase I to Phase II of REDD+



Conditions to apply for Results-based payments

Requirements to become eligible to apply for results-based payments:

- Preparation of National REDD+ Strategy (NRS)
- Establishment of Forest Reference Level (FRL)
- Establishment and operationalization of National Forest Monitoring System (NFMS)
- Establishment and operationalization of Safeguard Information System (SIS)

Among the four, FRL needs to be assessed by Technical Assistance of UNFCCC.

Achievements of Cambodia

National REDD+ Strategy (NRS)

NRS is in the process of approval by the Cambodian government.

Vision

Contribute to national and global climate change mitigation through improving the management of its natural resources and forest lands, and biodiversity conservation and sustainable development.

Mission

Strengthen the functioning and capacity of national and sub-national institutions for effective implementation of policies, laws and regulations to enhance management of natural resources and forest lands, and biodiversity conservation.

Goal

Reduce deforestation and forest degradation while promoting sustainable management, conservation of natural resources and contribute to poverty alleviation.

Scope and Scale

- Prioritizes deforestation measured through land use change and conversion of forest land. Build capacity alongside to address degradation.
- Implement REDD+ at the national level under the results-based payments mechanism of the UNFCCC.
- Consider implementation of sub- national and voluntary market based REDD+ projects subject to specific criteria.

Milestones and Results

By 2026 reduce its annual deforestation by half compared to the rate during the FRL period of 2006-2014.

Forest Reference Level (FRL)

Cambodia submitted a FFRL document to UNFCCC on November 2016. The assessment by a team of experts appointed by UNFCCC started in March 2017. After a series of question and answer sessions with the assessment team, Cambodia just returned its comment on the draft of assessment report to UNFCCC.

Scope of FRL

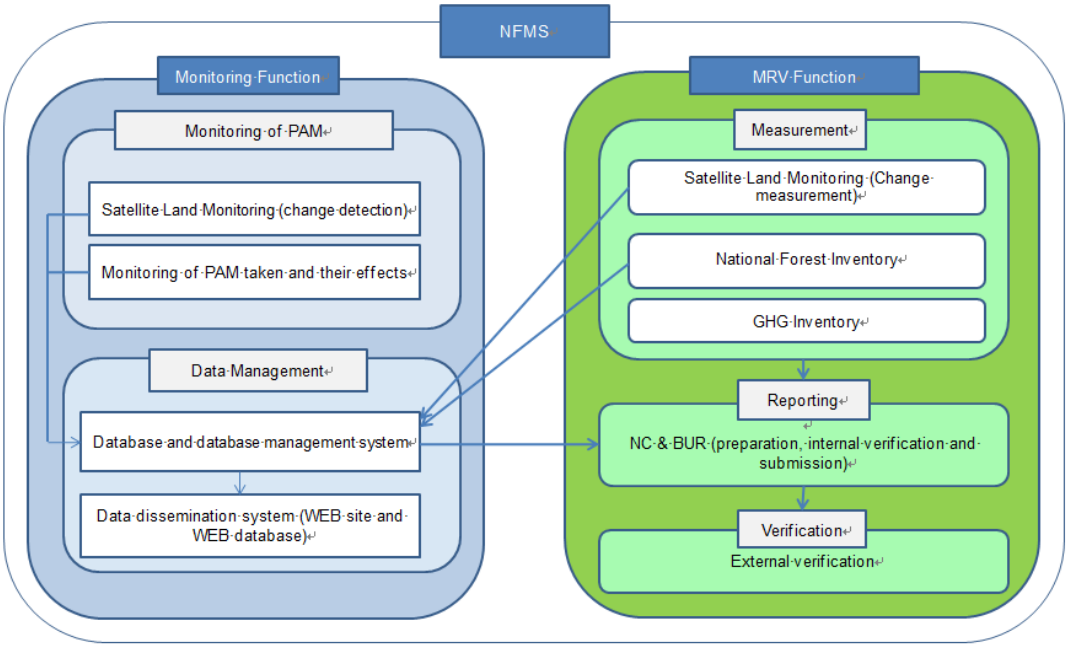
(1) Scale: National
(2) Activity data: Deforestation and also forest degradation and enhancements in areas of forest land remaining forest land but with changes in forest sub-categories, and removal of CO_2 from the atmosphere through afforestation where other land uses are converted to forest land.
(3) Carbon pool: AGB and BGB
(4) GHG: CO_2 only.
(3) Forest definition: 5 meters high at maturity, occupying minimum 0.5 hectares and minimum crown cover 10%.
(4) Reference period: 8 years between 2006 and 2014
(5) Methodology: Historical average of emission and removal
(6) Activity data: Land use/cover map of 2006, 2010 and 2014
(7) Emission factor: In principle selected from existing forest inventory survey data in Cambodia. If such data are not available used default value of IPCC guidelines.

National Forest Monitoring System (NFMS)

NFMS design document was prepared. NFI and WEB site were designed.

2nd National Communication was submitted to UNFCCC in 2015. Now the submission of a Biennial Update Report is being considered.

NFMS has two functions – MRV function and Monitoring function. MRV function is to measure GHG emission/removal which is used as the base for GHG inventory and reporting to UNFCCC. Monitoring part is for checking the effect of measures taken to address deforestation and forest degradation. Satellite land monitoring system is useful for both functions.



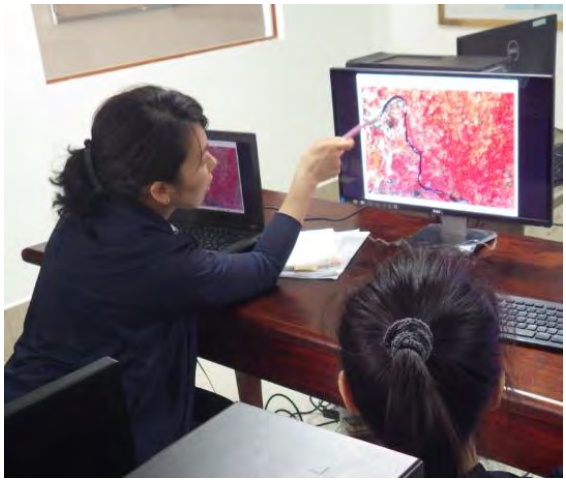
Included in Monitoring Function is Data Management function consisting of 1) Database and database management system and 2) Data dissemination system (WEB site and WEB database). By October 2017, a prototype data management system was designed including WEB design by the support from UN-REDD. For the moment, database is not connected to internet because of security reasons. A rule for data disclosure is now being examined to decide types of data to be uploaded to WEB site.

Phase I is a preparatory stage between 2011 and 2015.
Phase II is a development stage between 2016 and 2020
Phase III is an operational stage starting from 2021.

Need to make detailed design of monitoring part after policies and measures to address drivers of deforestation and forest degradation are determined.

Satellite Land Monitoring

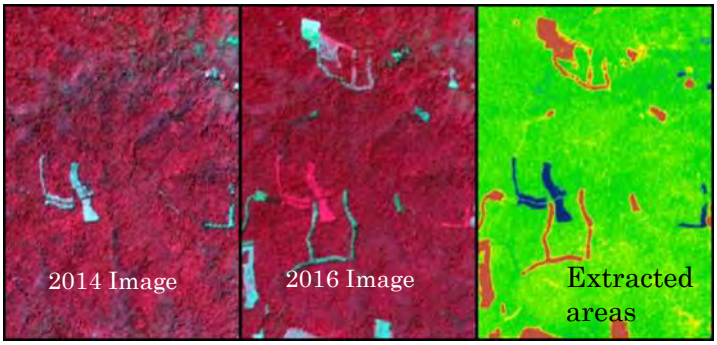
New methodology to improve efficiency and reliability of land use/cover mapping was introduced. Using the introduced methodology, 2006 and 2010 maps were upgraded and 2014 and 2016 maps were created.



Cambodia has been using satellite images for forest assessment even before the start of REDD+ readiness activities. Based on the basic capacity of Cambodian government officials, method to use satellite image for land use/cover mapping was upgraded. As a tool for accuracy assessment of land use/cover maps and also for quick assessment of forest area, Collect Earth tool of FAO was introduced.

Improved methodology

- Segmentation
- Logical check
- Principal component analysis for change detection

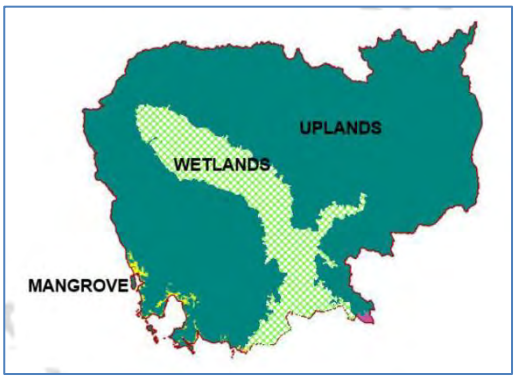


Extraction of areas of high possibility of land use/cover change by using Principal Component analysis.

National Forest Inventory (NFI)

The main objective of the sampling design for forest inventory is to reach a multipurpose, representative, consistent and realistic design for forest assessment in Cambodia. NFI manual and field forms have been developed and updated through field testing and NFI trials.

The proposed NFI design recommends stratifying the country into three strata: uplands, wetlands and mangrove areas. In each stratum, systematic cluster sampling is applied.



Allocation of plots:

Mangrove: 1st phase every 1km x 1km, 2nd phase every 3km x 3km (97 clusters)

Wetland: 4km x 4km :322 clusters

Upland: 6km x 6km: 2,751 clusters

Rectangular plot was chosen for upland forest while circular plot was chosen for mangrove. The proposed NFI design considers all the five carbon pools which have to be reported under the UNFCCC: aboveground biomass, belowground biomass, deadwood, soil organic carbon and litter.

Trial NFI was implemented in 25 clusters in conservation areas administered by the Ministry of Environment and in 25 clusters in community forests administered by the Forestry Administration of the Ministry of Agriculture, Forestry and Fisheries.

WEB Portal

The Cambodia NFMS WEB portal was developed as a part of Monitoring Function of the NFMS to provide the information of Cambodia's REDD+ activities to keep transparency of the information. In addition to updated report of Cambodia's REDD+ activities, spatial data will also be provided.

A fully functional web platform (which was based on technologies developed by FAO-UNREDD) has been setup in a shared server in France and customized based on the comments from MRV/FRL team.

For building up the Capacity of the MRV /REL team, two consultation meetings and three hand-on training on the management of web platform were conducted.

Next Steps

1. Preparation of Action Plan

Some policies and measures to address the drivers of deforestation and forest degradation are not the same for entire country. So, they should be selected for each sub-national area. Procedure to make REDD+ action plan will be as follows:

- Determine criteria for the selection of a sub-national area
- Select sub-national area using the criteria
- Analyze region specific drivers
- Determine policies and measures to address the drivers
- Design a mechanism to monitor the performance of selected policies and measures

Now, Cambodia is ready to prepare detailed action plan of REDD+.

2. Improvement and Further Development

Cambodia establishes its REDD+ related mechanism in a phased approach. While Cambodia has already prepared NFMS and FRL, they can be improved or developed further along with the availability of more reliable data or advanced techniques. Also, some parts of the design have not been fully developed due to the drastic reform of forestry and environmental sector of the government.

For NFMS, institutional arrangement needs to be worked out. For FRL, Activity Data and Emission Factor can be improved by increasing number of reliable land use/cover maps and by implementing one cycle of NFI.

Also, Cambodia may need to compile a Biennial Update Report if it seeks for the fund of pilot programme of Green Climate Fund. A new GHG inventory needs to be made.

ការឈានឆ្ពោះទៅដំណាក់កាលទី ២ នៃគម្រោងធនធានកសិកម្ម

សមិទ្ធផល និងជំហានបន្ទាប់

សេចក្តីព្រាង

វ៉ដបូកកម្ពុជា

កម្មវិធីកាត់បន្ថយការបំភាយឧស្ម័នពីការបាត់បង់ព្រៃឈើ និងការរិចរិលព្រៃឈើ និង តួនាទីនៃការអភិរក្ស ការគ្រប់គ្រងព្រៃឈើប្រកបដោយនិរន្តរភាព និង ការបង្កើនស្តុកកាបូនព្រៃឈើក្នុងបណ្តាប្រទេសកំពុងអភិវឌ្ឍ(វ៉ដបូក) គឺជាយន្តការផ្តល់នូវហិរញ្ញវត្ថុ លើសកម្មភាពដើម្បីកាត់បន្ថយឧស្ម័នផ្ទះកញ្ចក់ដែលបំភាយដោយការបាត់បង់ព្រៃឈើ និងការរិចរិលព្រៃឈើ។ តម្លៃនៃធនធានព្រៃឈើត្រូវបានរដ្ឋាភិបាលកម្ពុជាទទួលស្គាល់ជាយូរមកហើយ ហើយការប្រើប្រាស់ធនធានធម្មជាតិប្រកបដោយនិរន្តរភាពត្រូវបានដាក់បញ្ចូលជាមុំមួយក្នុងចំណោមមុំទាំងបួននៃ "យុទ្ធសាស្ត្របតុភោណសម្រាប់កំណើនការងារសមធម៌ និងប្រសិទ្ធភាព" នៃប្រទេសកម្ពុជា។

ប្រទេសកម្ពុជាចាត់ទុកវ៉ដបូក ជាវិធានការប្រកបដោយប្រសិទ្ធភាពមួយ ដើម្បីកាត់បន្ថយការបាត់បង់ព្រៃឈើ និងការរិចរិលព្រៃឈើ ហើយក្នុងឆ្នាំ ២០០៩ វ៉ែនទីបង្ហាញផ្លូវវ៉ដបូក ដែលមានបញ្ជាក់អំពីសកម្មភាពដែលត្រូវធ្វើ ដើម្បីអាចត្រៀមខ្លួនរួចរាល់សម្រាប់វ៉ដបូក ត្រូវបានបញ្ចប់រួចរាល់។ ដើម្បីអនុវត្តសកម្មភាពដែលត្រូវបានកំណត់ឃើញក្នុងវ៉ែនទីបង្ហាញផ្លូវ ដៃគូអភិវឌ្ឍជាច្រើន រួមទាំងអង្គការ JICA ផងបានសន្យាផ្តល់ការគាំទ្រ។

ក្នុងរយៈពេល ៦ ឆ្នាំកន្លងមកនេះ ប្រទេសកម្ពុជាមានការឈានឡើងយ៉ាងធំធេញក្នុងសកម្មភាពវ៉ដបូក របស់ខ្លួន រួមទាំងការដាក់របាយការណ៍កម្រិតយោងព្រៃឈើកម្ពុជា(FRL) ទៅអនុសញ្ញាក្របខ័ណ្ឌសហប្រជាជាតិស្តីពីការប្រែប្រួលអាកាសធាតុ (UNFCCC) ការរៀបចំយុទ្ធសាស្ត្រវ៉ដបូកជាតិ (NRS) ការរៀបចំប្រព័ន្ធតាមដានត្រួតពិនិត្យព្រៃឈើជាតិ (NFMS) និងធាតុផ្សំរបស់ប្រព័ន្ធនេះ ការធ្វើឱ្យប្រសើរឡើងនូវបច្ចេកទេសវាយតម្លៃ ការប្រើប្រាស់ដី/ គម្របដី និងការអនុវត្តគម្រោងបង្ហាញសម្រាប់ វ៉ដបូក។ រចនាបទគំនូសប្រព័ន្ធស្ថិរភាពវ៉ដបូក (SIS) បានទឹងកំពុងរៀបចំ។

សកម្មភាពវ៉ដបូក ត្រូវបានចែកជាបីដំណាក់កាល **ដំណាក់កាលទី ១** គឺជាដំណាក់ការត្រៀមខ្លួនរួចជាស្រេចសម្រាប់វ៉ដបូក **ដំណាក់កាលពី ២** គឺជាការអនុវត្តបង្ហាញ ឬដំណាក់កាលអនុវត្ត ហើយ **ដំណាក់កាលទី ៣** គឺជាការអនុវត្តវ៉ដបូកពេញលេញ សម្រាប់ការទូទាត់ដោយផ្អែកលើលទ្ធផល។ ប្រទេសកម្ពុជាបច្ចុប្បន្ន គឺស្ថិតនៅក្នុងដំណាក់កាលអន្តរកាល ដោយឈានចេញពីដំណាក់កាលទី ១ ទៅកាន់ដំណាក់កាលទី ២ ថ្វីបើចំណែកមួយចំនួននៃសកម្មភាពក្នុងដំណាក់ទី ២ ត្រូវបានអនុវត្តរួចហើយក្តី។

ឯកសារដ៏ខ្លីនេះ សង្ខេបឱ្យឃើញអំពីសមិទ្ធផលដែលប្រទេសកម្ពុជាសម្រេចបានទៅលើសកម្មភាពត្រៀមខ្លួនរួចជាស្រេចសម្រាប់វ៉ដបូក ក៏ដូចជាសកម្មភាពដែលត្រូវអនុវត្តនាពេលអនាគត។

ថ្ងៃទី ៥ ខែតុលា ឆ្នាំ ២០១៧

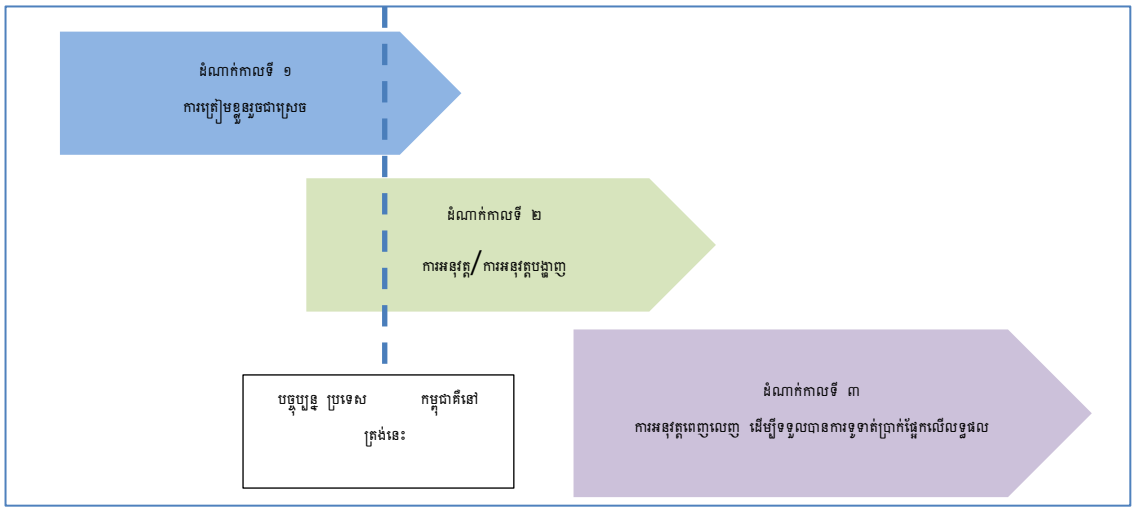
ក្រុមការងារបច្ចេកទេស MRV/REL

ក្រុមការងារវ៉ដបូកកម្ពុជា

ដំណាក់កាលរបស់រេដប្លូក

ប្រទេសកម្ពុជាកំពុងស្ថិតក្នុងដំណាក់កាលអន្តរកាលដោយផ្លាស់ចេញពីដំណាក់កាលទី ១ ទៅដំណាក់កាលទី ២ នៃ រេដប្លូក

លក្ខខណ្ឌ ដើម្បីស្នើសុំការទូរទាត់ ផ្អែកលើលទ្ធផល



លក្ខខណ្ឌតម្រូវដើម្បីឱ្យមានលក្ខណៈសម្បត្តិគ្រប់គ្រាន់សម្រាប់ស្នើសុំការទូទាត់ ផ្អែកលើលទ្ធផលជាក់ស្តែង៖

- ការរៀបចំឯកសារយុទ្ធសាស្ត្ររេដប្លូកជាតិ (NRS)
- ការរៀបចំឯកសារកម្រិតយោងព្រៃឈើ (FRL)
- ការបង្កើត និងការដាក់ឱ្យមានប្រតិបត្តិការនូវប្រព័ន្ធត្រួតពិនិត្យ តាមដានព្រៃឈើជាតិ (NFMS)
- ការបង្កើត និងការដាក់ឱ្យមានប្រតិបត្តិការប្រព័ន្ធព័ត៌មានសុវត្ថិភាពរេដប្លូក (SIS)

ក្នុងចំណោមតម្រូវការឯកសារ និងសមត្ថភាពទាំងបួននេះ ឯកសារកម្រិតយោងព្រៃឈើ(FRL) ចាំបាច់ត្រូវទទួលការវាយតម្លៃបច្ចេកទេស ពីក្រុមអ្នកបច្ចេកទេស UNFCCC។

សមិទ្ធផលរបស់ប្រទេសកម្ពុជា

យុទ្ធសាស្ត្រអនុវត្តបួកជាតិ (NRS)

យុទ្ធសាស្ត្រអនុវត្តបួកជាតិ កំពុងស្ថិតក្នុងដំណើរការ ស្នើសុំការអនុម័តពីទីស្តីការគណៈរដ្ឋមន្ត្រី។

ចក្ខុវិស័យ

យុទ្ធសាស្ត្រអនុវត្តបួក

ជាតិរួមចំណែកក្នុងការកាត់បន្ថយការប្រែប្រួលអាកាសធាតុជាតិ និងពិភពលោកតាម

រយៈការធ្វើឱ្យប្រសើរឡើងការងារគ្រប់គ្រងធនធានធម្មជាតិនិងដីព្រៃឈើ

ការអភិរក្សជីវៈចម្រុះ និងការអភិវឌ្ឍដោយចីរភាព។

។

បេសកកម្ម

ពង្រឹងមុខងារនិងសមត្ថភាពស្ថាប័ននៅថ្នាក់ជាតិ និងថ្នាក់ក្រោមជាតិ

ព្រមទាំងពង្រឹងប្រសិទ្ធភាពការអនុវត្តគោលនយោបាយ ច្បាប់

និងបទបញ្ជាគ្តិនានាដែលមានជាធរមាន

ដើម្បីធ្វើឱ្យប្រសើរឡើងលើការងារគ្រប់គ្រងធនធានធម្មជាតិ និងដីព្រៃឈើ

និងការអភិរក្សជីវៈចម្រុះឱ្យមានចិរន្តរភាព។

គោលបំណង

កាត់បន្ថយការបាត់បង់និងរួចរីលព្រៃឈើ

បន្តលើកកម្ពស់ការគ្រប់គ្រងនិងការអភិរក្សធនធានធម្មជាតិឱ្យមានចិរន្តរភាព

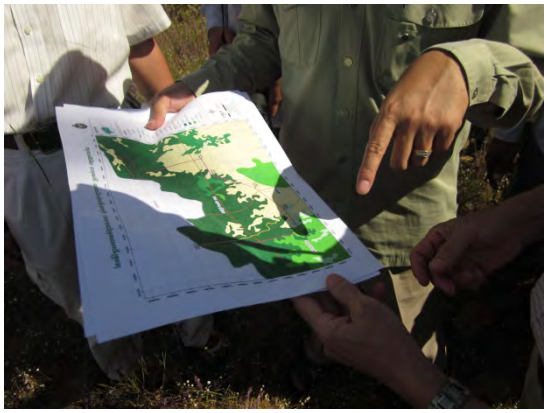
និងចូលរួមកាត់បន្ថយភាពក្រីក្រ ។

វិសាលភាព និងក្បខ្ឌិតអនុវត្តន៍

- ចាត់អាទិភាពចំពោះការបាត់បង់ព្រៃឈើ

  ដែលនឹងធ្វើការវាស់វែងតាមរយៈការប្រែប្រួលការប្រើប្រាស់ដីនិងការបម្លែង

  ដីព្រៃឈើ



- អនុវត្តរដបួក នៅថ្នាក់ជាតិនៅក្រោមយន្តការទូទាត់ផ្អែកលើលទ្ធផល

  នៃអនុសញ្ញាក្របខ័ណ្ឌសហប្រជាជាតិស្តីពីការប្រែប្រួលអាកាសធាតុ

- ពិចារណាអនុវត្តគម្រោងរដបួក ផ្អែកលើទីផ្សារនៅថ្នាក់ក្រោមជាតិ និង

  ក្រោមមូលដ្ឋាននៃការស្ម័គ្រចិត្ត ដែលជាកម្មវត្ថុនៃលក្ខខណ្ឌវិនិច្ឆ័យជាក់លាក់។

រំណាក់កាលសំខាន់ៗ និងលទ្ធផល

ត្រឹមឆ្នាំ ២០២០ កាត់បន្ថយការបាត់បង់ព្រៃឈើប្រចាំឆ្នាំរបស់ខ្លួនមកនៅត្រឹមរាក់

កណ្តាល បើប្រៀបធៀបជាមួយអត្រាបាត់បង់ក្នុងអំឡុងរយៈពេលយោង

នៃកម្រិតយោងព្រៃឈើ(FRL) ក្នុងចន្លោះឆ្នាំ ២០០៦-២០១៤។

កម្រិតយោងព្រៃឈើ (FRL)

ប្រទេសកម្ពុជាបានដាក់ឯកសារកម្រិតយោងព្រៃឈើ (FRL) ជូនទៅអនុសញ្ញាក្របខ័ណ្ឌសហប្រជាជាតិស្តីពីការប្រែប្រួលអាកាសធាតុ (UNFCCC) នៅខែវិច្ឆិកា ឆ្នាំ ២០១៦។ ការវាយតម្លៃបច្ចេកទេសដោយក្រុមអ្នកជំនាញការបច្ចេកទេស UNFCCC ចាប់ផ្តើមដំណើរការវាយតម្លៃក្នុងខែមីនា ឆ្នាំ ២០១៧។ បន្ទាប់ពីកម្រងវគ្គសំណួរ និងចម្លើយជាច្រើនជាមួយក្រុមការងារវាយតម្លៃបច្ចេកទេសមក ប្រទេសកម្ពុជាទើបតែបានផ្តល់មតិយោបល់របស់ខ្លួនទៅលើសេចក្តីព្រាងរបាយការណ៍វាយតម្លៃបច្ចេកទេសជូន UNFCCC វិញ។

វិសាលភាពរបស់ កម្រិតយោងព្រៃឈើ FRL

(១) កម្រិត៖ ថ្នាក់ជាតិ

(២) ទិន្នន័យសកម្ម៖ ការបាត់បង់ និង ការរិចរិលព្រៃឈើ និង ការធ្វើឱ្យប្រសើរឡើងនៅតំបន់ដីព្រៃឈើដែលនៅតែជាដីព្រៃឈើ ប៉ុន្តែមានការផ្លាស់ក្នុងចំណាត់ថ្នាក់ប្រភេទព្រៃឈើ និងការស្រូប CO_2 ពីបរិយាកាស តាមរយៈការដាំដុះព្រៃនៅត្រង់កន្លែងដែលការប្រើប្រាស់ដីដទៃទៀតត្រូវបានប្រែក្លាយទៅជាដីព្រៃ។

(៣) អាងកាបូន៖ ជីវម៉ាស់លើដី និងដីវម៉ាស់ក្រោមដី

(៤) ឧស្ម័នផ្ទះកញ្ចក់ ៖ ឧស្ម័ន CO_2

(៣) និយមន័យព្រៃឈើ៖ កម្ពស់ ៥ ម៉ែត្រ នៅក្នុង វ័យចំណាស់ គ្របដណ្តប់យ៉ាងតិច ០,៥ ហិចតា និងកំពូលចុងឈើអប្បបរមាគ្របដណ្តប់ ១០%

(៤) រយៈពេលយោង៖ ៨ ឆ្នាំ ចន្លោះពី ឆ្នាំ២០០៦ ដល់ ឆ្នាំ២០១៤

(៥) វិធីសាស្ត្រ៖ មធ្យមភាគកម្រិតយោងនៃការបំភាយ និងស្រូបឧស្ម័ន

(៦) ទិន្នន័យសកម្ម៖ ផែនទីប្រើប្រាស់ដី/គម្របដីព្រៃឈើក្នុងឆ្នាំ ២០០៦ , ២០១០ និង ២០១៤

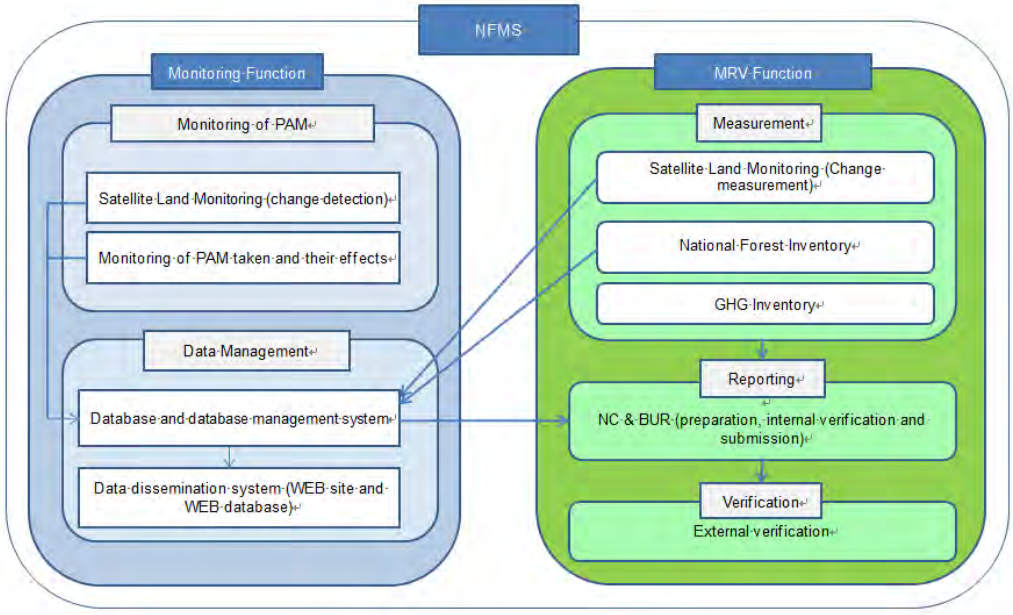
(៧) មេគុណបំភាយ៖ ជាគោលការណ៍មេគុណបំភាយត្រូវបានដកស្រង់ចេញពីបញ្ជីរទិន្នន័យសារធាតុកាបូនព្រៃឈើក្នុងប្រទេសកម្ពុជា។ ប្រសិនបើមិនមានទិន្នន័យប្រភេទនេះទេ តំលៃសន្មតនៅក្នុងឯកសារគោលការណ៍ណែនាំរបស់ IPCC ត្រូវបានយកមកប្រើ។

ប្រព័ន្ធត្រួតពិនិត្យ តាមដានព្រៃឈើជាតិ

ឯកសារប្រព័ន្ធត្រួតពិនិត្យ តាមដានព្រៃឈើ ត្រូវបានរៀបចំតាមរយៈការ កសាង ទីតាំង NFI និង WEB

របាយការណ៍ជាតិលើកទីពីរ ត្រូវបានដាក់ជូនទៅ UNFCCC ក្នុងឆ្នាំ ២០១៥ និងពេលបច្ចុប្បន្នកំពុង ពិចារណាផ្តល់ជូនរបាយការណ៍ BUR។

NFMS មានមុខងារពីរជាអាទិ៍ មុខងារ MRV និងមុខងារ ត្រួតពិនិត្យ។ មុខងារ □□□□□□□ រ□ណ៍ □□□□□□□□□□□□□□□ (MRV) គឺដើម្បីវាស់វែងការបំភាយ/ការស្រូប ឧស្ម័នផ្ទះកញ្ចក់ ដែលត្រូវបានប្រើប្រាស់ជាមូលដ្ឋាន សម្រាប់ សារពើភ័ណ្ឌឧស្ម័នផ្ទះកញ្ចក់ (GHG) និងការរាយការណ៍ជូនទៅ UNFCCC។ មុខងារត្រួតពិនិត្យគឺដើម្បីវាស់វែង និងកំណត់ការបាត់បង់ និងការរិចរិលព្រៃឈើ។ ប្រព័ន្ធ ត្រួតពិនិត្យដ៏ងាយប្រើប្រាស់ផ្តាយរណប មានសារៈប្រយោជន៍សម្រាប់មុខងារទាំងពីរនេះ។



នៅក្នុងមុខងារត្រួតពិនិត្យ គឺការគ្រប់គ្រងទិន្នន័យដែលក្នុងនោះរួមមានសមាសធាតុ ១) មូលដ្ឋានទិន្នន័យ និងប្រព័ន្ធគ្រប់គ្រងមូលដ្ឋានទិន្នន័យ និង ២) ប្រព័ន្ធផ្សព្វផ្សាយទិន្នន័យ (គេហទំព័រ អ៊ីនធើណែត និង គេហទំព័រមូលដ្ឋានទិន្នន័យ)។ គិតមកត្រឹមខែតុលា ឆ្នាំ ២០១៧ ប្រព័ន្ធគ្រប់គ្រងទិន្នន័យបឋម ត្រូវបានរចនា ដោយក្នុងនោះមានការរចនាគេហទំព័រ ដែលគាំទ្រ ដោយ UN-REDD។ សម្រាប់ពេលនេះ មូលដ្ឋានទិន្នន័យនៅមិនទាន់ភ្ជាប់ទៅកាន់អ៊ីនធើណែតឡើយ ដោយសារតែមូលហេតុផ្នែកសន្តិសុខទិន្នន័យ។ ការដាក់បង្ហាញទិន្នន័យ បច្ចុប្បន្នកំពុងត្រូវ បានពិនិត្យ ដើម្បីសម្រេចចិត្តលើប្រភេទទិន្នន័យដែលនឹងត្រូវដាក់បង្ហោះទៅក្នុង គេហទំព័រ

ដំណាក់កាលទី ១ គឺជាដំណាក់កាលត្រៀមរៀបចំនៅចន្លោះឆ្នាំ ២០១១ ដល់ឆ្នាំ ២០១៥។

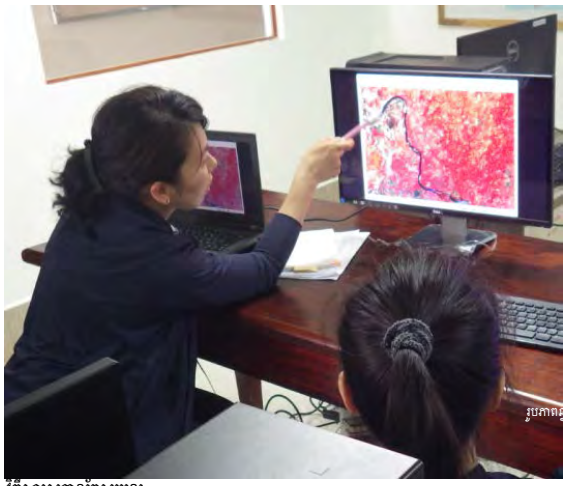
ដំណាក់កាលទី ២ គឺជាដំណាក់កាលអភិវឌ្ឍនៅចន្លោះឆ្នាំ ២០១៦ ដល់ ឆ្នាំ ២០២០។

ដំណាក់កាលទី ៣ គឺជាដំណាក់កាលប្រតិបត្តិ ដោយចាប់ផ្តើមពីឆ្នាំ ២០២១ តទៅ។

ចាំបាច់ត្រូវធ្វើការចន្ទាលម្អិតលើផ្នែកត្រួតពិនិត្យ បន្ទាប់ពី បានកំណត់ នូវគោលនយោបាយ និងវិធានការដែលអាចវាស់ដែង បុព្វហេតុឬកត្តាជម្រុញឱ្យមានការបាត់បង់ និងការរិចរិលព្រៃឈើ។

ការត្រួតពិនិត្យដីដោយប្រព័ន្ធផ្កាយរណប

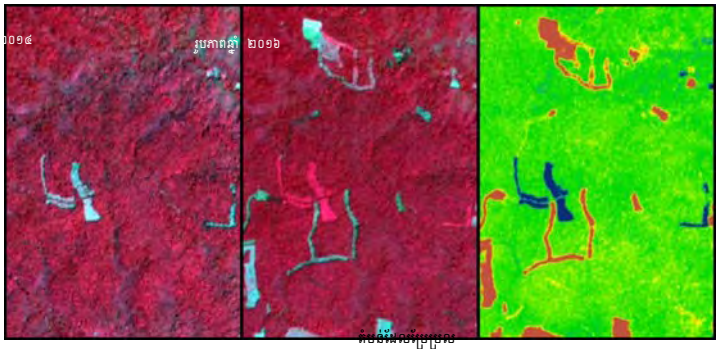
បច្ចេកវិទ្យាថ្មីត្រូវបានណែនាំ ដើម្បីកែលម្អប្រសិទ្ធភាព និងភាពជឿជាក់នៃការផលិតផែនទីប្រើប្រាស់ដី/គម្របដីព្រៃឈើ។ តាមរយៈការណែនាំ បច្ចេកវិទ្យាថ្មី ត្រូវបាន ប្រើប្រាស់សម្រាប់កែលម្អផែនទីឆ្នាំ២០០៦ និង ២០១០ និងសម្រាប់ ផលិតបន្តែមផែនទី ឆ្នាំ ២០១៤ និង ២០១៦ ។



វិធីសាស្ត្របានកែសម្រួល

- ការវិញ្ជកព្រំប្រទល់ទៅតាមបណ្តុំពណ៌ផ្កាយរណប
- ការពិនិត្យគុណភាព
- ការវិភាគសមាសធាតុគោលសម្រាប់ការអនុឱ្យឃើញនូវការប្រែប្រួល

ប្រទេសកម្ពុជាបានប្រើប្រាស់រូបភាពផ្កាយរណបសម្រាប់ការវាយតម្លៃព្រៃឈើ តាំងពីមុនការចាប់ផ្តើមសកម្មភាពត្រៀមលក្ខណៈ សម្រាប់ដងឬក មកម្ល៉េះ។ ផ្អែកលើសមត្ថភាពជាមូលដ្ឋានរបស់មន្ត្រីរដ្ឋាភិបាលកម្ពុជា ការប្រើប្រាស់រូបភាពផ្កាយរណបសម្រាប់ការធ្វើផែនទីប្រើប្រាស់ដី/គម្របដីព្រៃឈើត្រូវបានកែលម្អ។ Collect Earth របស់អង្គការស្បៀង និងកសិកម្មនៃសហប្រជាជាតិ (FAO) ត្រូវបានណែនាំឱ្យប្រើប្រាស់ សម្រាប់វាយតម្លៃសុក្រឹត្យភាពនៃផែនទីដីព្រៃឈើ ព្រោះវាជាឧបករណ៍វាយតម្លៃរហ័សមួយ ជាពិសេសតំបន់ដីព្រៃឈើ ។



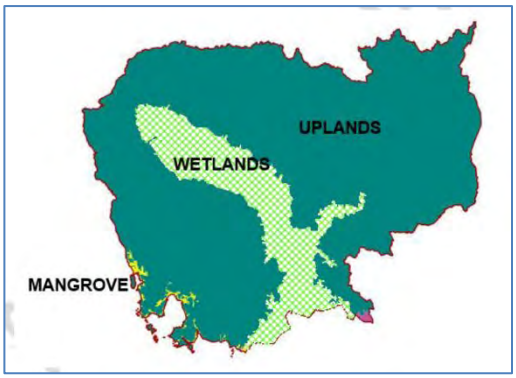
តំបន់ដែលមានការប្រែប្រួល

តំបន់មានមានការផ្លាស់ប្តូរខ្លាំងទៅលើការប្រើប្រាស់ដី/គម្របដី តាមរយៈការប្រើប្រាស់ការវិភាគសមាសធាតុគោល

បញ្ជីសារពើភ័ណ្ឌព្រៃឈើជាតិ (NFI)

គោលបំណងចម្បងនៃការរចនាសំណាក គឺការរៀបចំក្នុងគោលបំណងច្រើនយ៉ាង តំណាងឆាយ សង្គតភាព និងភាពអាចជឿជាក់បាន សម្រាប់ការប៉ាន់ប្រមាណព្រៃឈើក្នុងប្រទេសកម្ពុជា។ សៀវភៅណែនាំសារពើភ័ណ្ឌព្រៃឈើជាតិនេះ (NFI) ត្រូវបានបង្កើតឡើង និងកែសម្រួលទៅតាមការធ្វើតេស្តសាកល្បងប្រើប្រាស់នៅទីវាល។

សំណើនៃការរៀបចំសារពើភ័ណ្ឌព្រៃឈើជាតិ(NFI) ជាអនុសាសន៍បែងចែកប្រទេសកម្ពុជាទៅជាបីស្រទាប់ ពោលគឺ តំបន់ព្រៃលើ តំបន់ដីសើម និងតំបន់ព្រៃកោងកាង។ នៅក្នុងស្រទាប់នីមួយៗ សំណាកនៃកម្រងឡូត៍ជាលក្ខណៈប្រព័ន្ធត្រូវបានអនុវត្តសម្រាប់ការតាំងសំណាកនៅទីវាល។ កម្រងឡូត៍គំរូ គឺជាឯកតាសំណាកបឋម។ បណ្តាឡូត៍ និងដើមឈើ គឺជាឯកតាការកត់ត្រាសម្រាប់ការកត់ត្រាទិន្នន័យ។



ទីតាំងឡូត៍៖

ព្រៃកោងកាង៖

ដំណាក់កាលទី ១ ១គ.ម × ១គ.ម

ដំណាក់កាលទី ២ ៣គ.ម × ៣គ.ម (៩៧ កម្រងឡូត៍)

តំបន់ដីសើម៖ ៤គ.ម × ៤គ.ម (៣២២ កម្រងឡូត៍)

តំបន់ខ្ពស់៖ ៦គ.ម × ៦គ.ម៖ (២៧៥១ កម្រងឡូត៍)

សៀវភៅណែនាំ NFI រចនាឡូត៍រាងជាចតុកោណ និងឡូត៍ជារង្វង់ ដោយផ្អែកលើសណ្ឋានដី និងស្រទាប់រុក្ខជាតិ។ សំណើនៃការរៀបចំសារពើភ័ណ្ឌព្រៃឈើជាតិ NFI ដែលត្រូវបាន ពិចារណាលើអាងការបូនទាំងប្រាំ ដែលចាំបាច់ត្រូវរាយការណ៍ជូន UNFCCC មានដូចជា ជីវម៉ាសនៅលើដី ជីវម៉ាសនៅក្រោមដី ឈើងាប់ កាបូនសរីរាង្គដី និងកំទេចកំទីលើដី។

សាកល្បង NFI ត្រូវបានអនុវត្តនៅ ចំនួន ២៥ កម្រងឡូត៍ ក្នុងតំបន់អភិរក្សក្រោមក្រសួងបរិស្ថាន និង ២៥ កម្រងឡូត៍ នៅក្នុងព្រៃសហគមន៍ ក្រោមរដ្ឋបាលព្រៃឈើ នៃក្រសួងកសិកម្ម រុក្ខាប្រមាញ់ និងនេសាទ។

គេហទំព័រ (WEB portal)

គេហទំព័រប្រព័ន្ធ ត្រួតពិនិត្យ តាមដានព្រៃឈើ (NFMS) កម្ពុជា ត្រូវបានកសាងឡើងសម្រាប់គាំទ្រមុខងារត្រួតពិនិត្យ ធ្វើរបាយការណ៍ និងចែករំលែកព័ត៌មានទាក់ទងនឹងវឌ្ឍន៍ភាពសកម្មភាពរដឋបឋកកម្ពុជា ។ គេហទំព័រ NFMS សម្រាប់ដើម្បីចូលរួមបង្ហាញពីតម្លាភាព ភាពត្រឹមត្រូវ នូវរាល់ការអនុវត្តសកម្មភាព បច្ចេកទេសនានារបស់កម្មវិធីរដឋបឋកជូនសហគមន៍ជាតិ និងអន្តរជាតិ។

មុខងាររបស់គេហទំព័រ (ផ្អែកលើបច្ចេកវិទ្យាអភិវឌ្ឍ ដោយក្រុមការងារ UNREDD) ត្រូវបានតម្លើងនៅក្នុង server ប្រទេសបារាំង និងកែតម្រូវ តាមតម្រូវការរបស់ប្រទេស ស្របតាមមតិយោបល់ពីក្រុមការងារ MRV/FRL។

សម្រាប់ការកសាងសមត្ថភាពក្រុមការងារ MRV /REL កិច្ចប្រជុំពិគ្រោះយោបល់ចំនួនពីរ និងការបណ្តុះបណ្តាលអនុវត្តផ្ទាល់ចំនួនបីស្តីពីការគ្រប់គ្រងប្រើប្រាស់ និងកែសម្រួល គេហទំព័រ ត្រូវបានរៀបចំឡើង។

ជំហានបន្ទាប់

1. ការរៀបចំផែនការសកម្មភាព

គោលនយោបាយ និងវិធានការដែលអាចវាស់វែង បុព្វហេតុ ឬកត្តាជម្រុញឱ្យមានការបាត់បង់ និងការរិចរិលព្រៃឈើ គឺមិនអាចប្រើប្រាស់តែមួយវិធី សម្រាប់អនុវត្តទូទាំងប្រទេសទេ។ ហេតុនេះ គួររើសធីសគោលនយោបាយ និងវិធានការសម្រាប់តំបន់ថ្នាក់ក្រោមជាតិនីមួយៗ។ ទីតាំងដើម្បីធ្វើផែនការសកម្មភាពដងបូក ទីងមាន លក្ខណៈដូចខាងក្រោម៖

- កំណត់លក្ខខណ្ឌវិនិច្ឆ័យសម្រាប់ជ្រើសធីសតំបន់នៅថ្នាក់ក្រោមជាតិ
- ជ្រើសធីសតំបន់ថ្នាក់ក្រោមជាតិ ដោយប្រើប្រាស់លក្ខខណ្ឌវិនិច្ឆ័យ
- វិភាគទីតាំងទៅតាមស្ងួចនាករ
- កំណត់គោលនយោបាយ និងវិធានការដើម្បីឆ្លើយតបទៅនឹងស្ងួចនាករ
- រចនាយន្តការ ដើម្បីពិនិត្យតាមដានលទ្ធផលការងារនៃគោលនយោបាយ និងវិធានការដែលត្រូវបានជ្រើសធីស

ពេលនេះ ប្រទេសកម្ពុជាបានត្រៀមខ្លួនរួចរាល់ ដើម្បីរៀបចំផែនការសកម្មភាពលម្អិតសម្រាប់ដងបូក។

2. ការកែលម្អ និងផែនការណ៍សកម្មភាពនាពេលអនាគត់

ប្រទេសកម្ពុជាបានបង្កើតយន្តការពាក់ព័ន្ធជាមួយដងបូក របស់ខ្លួនក្នុងយុទ្ធវិធីតាមដំណាក់កាល។ ថ្វីបើ កម្ពុជាបានរៀបចំឯកសារ NFMS និង FRL រួចហើយក្ត ប៉ុន្តែនៅតែមានលទ្ធភាពអាចកែលម្អ ឬធ្វើបច្ចុប្បន្នភាពឯកសារទាំងនេះបន្ថែមទៀត នៅពេលមានទិន្នន័យកាន់តែគួរឱ្យទុកចិត្តបាន ឬបច្ចេកវិទ្យាជឿនលឿនថែមទៀត។ ដូចគ្នានេះដែរ ផ្នែកមួយចំនួននៃការចនានៅពុំទាន់បានអភិវឌ្ឍពេញលេញនៅឡើយ ដោយសារតែកំណែទម្រង់ដ៏គំហុកនៅក្នុងវិស័យព្រៃឈើ និងបរិស្ថានរបស់រដ្ឋាភិបាល។

សម្រាប់ NFMS ចាំបាច់ត្រូវធ្វើការដោះស្រាយបញ្ហាការរៀបចំផ្នែកស្ថាប័ន។

សម្រាប់ FRL, ទិន្នន័យសកម្ម និង មេគុណបំភាយ អាចកែលម្អបន្ថែមទៀតតាមរយៈការបង្កើនចំនួនផែនទីប្រើប្រាស់ដី/ផែនទីគម្របដីដែលគួរឱ្យទុកចិត្តបាន តាមរយៈការអនុវត្តវដ្តមួយជុំនៃ NFI។

ដូចគ្នានេះដែរ ប្រទេសកម្ពុជាចាំបាច់ត្រូវចងក្រងរបាយការណ៍បច្ចុប្បន្នភាពរៀងរាល់ពីរឆ្នាំម្តងប្រសិនបើ កម្ពុជារង្វើការស្នើសុំបរិញ្ញាប្បទានពីមូលនិធិអាកាសធាតុបៃតង។

別添資料 2

JICA 技術支援チームの出席した主要会議

JICA 技術支援チームの出席した主要会議
(主要な MRV/REL 技術チーム会議含む)

＜第一年次＞

日付	議題
2011/11/17	UN-REDD のインセプションワークショップ
2011/11/19	UN-REDD の活動計画を検討するための FAO との会議
2011/11/29	カンボジアの MRV/REL の手法に関する、FAO 本部との情報交換会議（インターネット会議）
2012/1/30	UN-REDD プログラム実施内容に関する FAO 本部との会議（インターネット会議）
2012/2/6	UN-REDD の活動計画検討のための FAO 本部との会議（インターネット会議）
2012/2/8-9	REDD+ 交渉官会議
2012/9/28	FAO の NFI/FAO-TCP プログラム　インセプション会議
2012/10/25	カンボジア REDD+ タスクフォース 会議
2012/10/3	CAM-REDD の JCC
2012/10/3	UNREDD の PEB 会議
2012/10/23,25	CI Japan による Prey Lang 地区の REDD+プロジェクトに関するコンサルテーション会議
2012/11/5-7	GHG インベントリーワークショップ
2012/11/22	NFI に関する Technical Working Group 会議
2012/12/10	森林研究整備機構によるワークショップ
2013/1/15	森林研究整備機構によるセミナー

＜第二年次＞

日付	議題
2013/5/22	UNDP による REDD+に関するセミナー
2013/7/29	APFNET のワークショップ
2013/9/11	CAM-REDD の JCC
2013/10/7	森林研究整備機構とカンボジア森林研究所による、社会経済セーフガードに関する国際ワークショップ
2014/1/13	CAM-REDD の JCC
2014/2/20	CAM-REDD の JCC（JICA の中間評価団報告）
2014/6/6	REDD+ タスクフォース会議
2014/7/21	FAO による Land Cover Classification System のワークショップ
2014/8/7	REDD+戦略策定に関する最初の会議
2014/12/12	JICA 技術支援チーム主催の NFMS ワークショップ

＜第三年次＞

日付	議題
2015/5/4-5	森林参照レベル検討会議
2015/5/18	REL と NFMS に関する MRV/REL 技術チーム会議

2015/5/20-21	国家 REDD+戦略に関するコンサルテーション会議
2015/6/3	FRL 設定の特別チーム編成会議
2015/7/2	国家 REDD+戦略策定会議（戦略の内容検討）
2015/6-7	国家 REDD+戦略コンサルテーション会議
2015/7/10	FRL の内容検討会議
2015/7/27	国家 REDD+戦略検討会議
2015/8/4	国家 REDD+戦略検討会議
2015/8/10	国家 REDD+戦略検討会議
2015/9/23	FRL に関する戦略検討会議
2015/10/9	NFMS ワークショップ
2015/10/30	FRL に関する会議
2015/11/3/-4	森林局年次総会（FRL 設計について説明）
2015/11/16-17	NFMS 会議（NFMS 素案について関係者からの意見収集）
2015/11/9	国家 REDD+戦略と NFMS に関する会議（原稿の内容検討）
2016/3/2	CAM-REDD の JCC 会議
2016/6/29	カンボジアの FRL と NFMS 設計の中間報告のためのワークショップ
2017/6/29	FRL と NFMS に関するワークショップ（現状報告）
2017/8/24-25	MRV/REL 技術チームの役割見直し会議

別添資料 3

国家森林モニタリングシステム（NFMS）（Version 1）

NATIONAL FOREST MONITORING SYSTEM OF CAMBODIA

(Draft)

Ver.1_10

May 2016

Acknowledgements

The Royal Government of Cambodia expresses its sincere gratitude to national ministries and agencies, development partners, non-governmental organizations, academia, the private sector and all stakeholders for their contribution to the development of the draft National Forest Monitoring System (NFMS) of Cambodia.

The draft NFMS was developed under the overall coordination of the Ministry of Agriculture, Forestry and Fisheries (MAFF), including Forestry Administration and Fisheries Administration, with the active participation of the Ministry of Environment (MoE) and invaluable guidance from the Cambodia REDD+ Taskforce, Technical Teams, Consultation Group and Gender Group. Their participation made the NFMS more coherent and aligned to other existing sectoral plans of the line ministries and agencies. The suggestions and comments received from stakeholders a series of consultative meetings offered strategic guidance for development of the NFMS. A wide range of technical support was generously given by several national and international experts for the development of the NFMS.

The development of the NFMS was made possible with the financial and technical support from development partners, namely the United Nations *Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (UN-REDD Programme), the World Bank's Forest Carbon Partnership Facility (FCPF), United Nations Development Programme (UNDP) and Japan International Cooperation Agency (JICA).*

TABLE OF CONTENTS

List of Abbreviations and Acronyms

AD	Activity Data
BUR	Biennial Update Report
CAM-REDD	Cambodian REDD+ program
COP	Conference of the Parties
DFC	Department of Forestry and Community Forest
EF	Emission Factor
FAO	Food and Agriculture Organization of the United Nations
FA	Forestry Administration, MAFF
FiA	Fisheries Administration, MAFF
FREL	Forest Reference Emission Level
GDANCP	General Department of Administration for Nature Conservation and Protection (Cambodia)
GIS	Geographic Information System
GHG	Greenhouse Gas
GSSD	General Secretariat for Sustainable Development
ICA	International Consultation and Analysis
IPCC	Intergovernmental Panel on Climate Change
JICA	Japan International Cooperation Agency
MAFF	Ministry of Agriculture, Forestry and Fisheries
MoE	Ministry of Environment
MRV	Measurement, Reporting and Verification
NC	National Communication
NFI	National Forest Inventory
NFP	National Forest Programme
NFMS	National Forest Monitoring System
NPASMP	National Protected Areas Strategic Management Plan
PAM	Policies and Measures
PFE	Permanent Forest Estate
QA/QC	Quality Assurance/Quality Control
REDD+	Reducing emissions from deforestation and forest degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries
RGC	The Royal Government of Cambodia
RS	Remote Sensing

RUA	Royal University of Agriculture
RUPP	Royal University of Phnom Penh
SIS	Safeguard Information System
SLMS	Satellite Land Monitoring System
SPFF	Strategic Planning Framework for Fisheries
UNFCCC	United National Framework Convention on Climate Change
UN-REDD	The United Nations Collaborative Programme on REDD
WFA	Watershed Management and Forest Cover Assessment Office of FA

Executive Summary

Effective policies and measure to address deforestation and forest degradation depend on reliable information on forest and socio-economic conditions of the target area. The assessments of the outputs of implemented policies and measures also depend on the tinformation that is collected during and after implementation.

There are three government agencies responsible for the management of forests in Cambodia, including the Forestry Administration (FA), the Fisheries Administration (FiA) in the Ministry of Agriculture, Forestry a/nd Fisheries, and the General Department of Administration of Nature Conservation and Protection (GDANCP) in the Ministry of Environment.

The FA has assessed forest conditions every four years since 2002 by producing national forest cover maps using satellite images. While not covering the entire country in a systematic manner, forest inventory surveys have been implemented in various parts of the country and at various times for a variety of purposes. There are also reporting mechanisms that have been established to transfer information from local offices of the Forestry Administration (FA), Fisheries Administration (FiA) and the Ministry of Environment (MoE) to their respective central offices.

In an effort to implement more efficient policies and measures to address deforestation and forest degradation and to become eligible to receive results-based payments for the implementation of REDD+ activities, the parties are obliged to establish a national forest monitoring system. Cambodia will establish such a system based on prevailing mechanisms and modalities by 2020 in a phased approach. The target of GHG inventories will be to assess five carbon pools to achieve the Tier 2 level.

Chapter 1. Background and Purpose

Monitoring forest condition is the basis of effective forest management and forest assessments in Cambodia have been conducted every four years since 2002. Forest inventory surveys have been implemented in various parts of the country and at various times, as well, although they do not cover the entire country in a systematic manner. There are also reporting mechanisms that are used to transfer information from local offices of the Forestry Administration (FA), Fisheries Administration (FiA) and the Ministry of Environment (MoE) to their respective central offices.

The development of a National Forest Monitoring System (NFMS) was listed under a COP 19 decision as one of four conditions required for parties to become eligible to apply for results-based payments under REDD+. In its effort to ensure compliance with that requirement, Cambodia is in the process of developing a National Forest Monitoring System (NFMS) that will be useful for not only monitoring REDD+ activities, but also for monitoring the performance of other forest management activities, as well.

The effort to establish a National Forest Monitoring System in Cambodia was initiated in 2011 prior to the formal establishment of the REDD+ Taskforce and the MRV/REL Technical Team under the REDD+ Taskforce. Available maps and forest inventory survey data were analyzed at that time and a provisional conceptual framework for developing the NFMS was established. The process to develop the NFMS accelerated with advances made by the MRV/REL Technical Team subsequent to its establishment. Proposals for the design of the interrelated National Forest Inventory (NFI) and the production of the NFI Field Manual were developed in parallel with the review of existing land use/cover classes, as well as with the introduction of new mapping technologies and the construction of a database management system and companion WEB interface site.

This draft document describes the phased approach planned to be used to design the NFMS in Cambodia.

Chapter 2. UNFCCC Requirements

The principal COP decisions that have defined the requirements of an NFMS developed to implement REDD+ activities include:

Decision 4 of COP 15 in 2009 in Copenhagen, Denmark

The Conference of the Parties requests developing country Parties to establish, according to national circumstances and capabilities, robust and transparent national forest monitoring systems that:

(1) 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;

(2) Provide estimates that are transparent, consistent, as far as possible accurate, and that reduce uncertainties, taking into account national capabilities and capacities;

(3) Are transparent and their results are available and suitable for review as agreed by the Conference of the Parties

Decision 1 of COP 16 in 2010 in Cancun, Mexico

The Conference of the Parties requests developing country Parties to develop the following elements:

(c) A robust and transparent national forest monitoring system for the monitoring and reporting of the five activities: (1) Reducing emissions from deforestation, (2) reducing emissions from forest degradation, (3) conservation of forest carbon stocks, (4) sustainable management of forests and (5) enhancement of forest carbon stocks, with the provisions contained in decision 4 of COP15.

Decision 11 of COP 19 in 2013 in Warsaw, Poland

The conference of the Parties decides that national forest monitoring systems should

(a) Build upon existing systems, as appropriate;

(b) Enable the assessment of different types of forest in the country, including;

natural forest, as defined by the Party;

(c) Be flexible and allow for improvement;

(d) Reflect, as appropriate, the phased approach as referred to in Decision 1 of COP 16.

Chapter 3. Current Forest Monitoring in Cambodia

3.1. General situation

The current state and distribution of the four major classifications of forests in Cambodia that include Evergreen, Semi-evergreen, Deciduous and Other forest types have been monitored every four years since 2002 in forest cover assessments conducted by the FA.

The FA and the other two government agencies responsible for forest management in the country, the FiA and the MoE, have similar monthly, quarterly, semi-annual and annual reporting processes that are used to collect and transmit information from local offices. Reports regarding illegal activities are reported to the central offices of each of these organizations to support appropriate government deterrent actions. There is a mechanism to collect information on community forestry practices that is currently under design, as well.

3.2. Institutional structure

There are three government agencies responsible for forest resources management in Cambodia, the FA, FiA and the MoE. The FA is responsible for reporting the assessment of forest cover conditions throughout the country, as well as for producing nationwide wall-to-wall land use/cover maps. Field forest inventory assessments are implemented separately by each of the three agencies, as well.

3.3. General status of forest condition in Cambodia

Cambodia established its National Forest Programme (NFP) in 2010 to support its forest reform program to ensure sustainable forest resources management. The NFP is based on the vision outlined and well-embedded in the Statement of the Royal Government of Cambodia on National Forest Sector Policy. That vision states that"The Royal Government of Cambodia considers the ecologically, socially and economically viable conservation and management of forest resources as a major pillar of public welfare directly contributing to environmental protection, poverty reduction and socio-economic development."

National forest definition for sustainable forest management

Under the NFP, the term 'forest' is defined in the following manner:

> *Forest is the unit of natural ecosystem or plantation in the form of wetland, low land and dry land which covers by natural stands of plantation trees with a height from 5 meters on an area at least 0.5 hectares with a canopy of more than 10 percent The plantations such as rubber, oil palm, teak, acacia and eucalyptus and other kinds of trees which fall under the above criteria will also be classified as forests.*

The FA adheres to this definition in implementing its national sustainable forest management programs. Prior to 1970, forests covered about 73 % of the country's land area. Those forests have since been subjected to an irregular recurring pattern of deforestation and degradation as the result of civil war and social unrest, illegal logging, shifting agriculture, forestland encroachment and the conversion of forestland to other land uses.

The assessment that was conducted in 2002 indicated that forest cover had declined to 61.15%. Forest cover continued to decline, first to 59.09% in 2006 and then to 57.07% in 2010. Figure 1 depict the most recent assessment conducted in 2014, indicates that forest cover declined to 49.48%. Table 1 summarizes these changes in forest cover between 2006 and 2014.

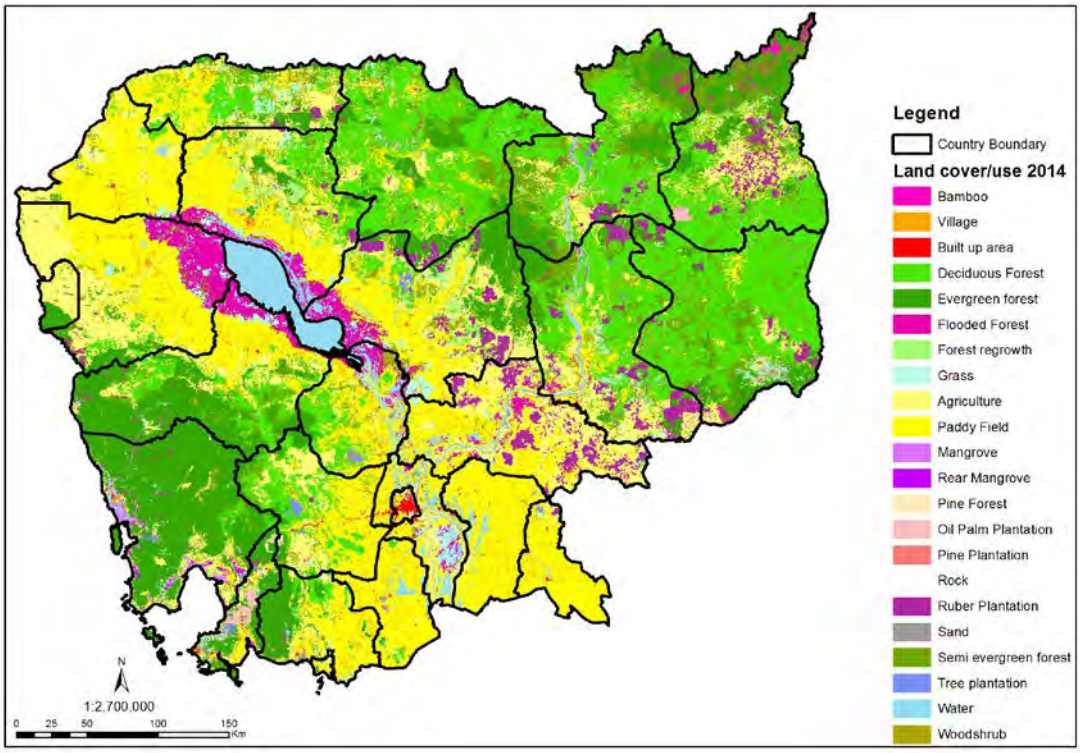


Figure 1. Land use/cover map in Cambodia in 2014.

Forest Type	2006	2010	2014
Evergreen	20.20%	19.27%	16.38%
Semi-evergreen	7.50%	7.02%	6.10%
Deciduous	25.84%	24.68%	19.17%
Other forest	5.55%	6.10%	7.83%
Total forest	59.09%	57.07%	49.48%

Table 1. Forest cover change in Cambodia from 2006-2014.

Forests in Cambodia are under the general jurisdiction of the Ministry of Agriculture, Forestry and Fisheries (MAFF), with the FA charged as the responsible Government Authority (2002 Forestry Law, Article 3), the MoE responsible for the management of Protected Areas, and the FiA responsible for the management of flooded forests and mangrove areas (2006 Fisheries Law, Article 3). Cambodian Law is hierarchical and subsidiary regulations are subject to the differentiation of responsibilities stipulated in the Forestry Law, as well as in other related laws. Since subsidiary regulations cannot amend responsibilities stipulated in a law, management and regulatory jurisdictional authority over forest resources in Cambodia is under the responsibility of several

different government agencies as defined in Cambodian Law (e.g., 2006 Fisheries Law, 2002 Forestry Law, 2001 Land Law, 2008 Protected Areas Law, 1996 Environmental Protection and Natural Resources Management Law, 1993 Royal Decree on Creation and Determination of Nature Reserves, and 2009 Sub-decree # 83 on Registration of Land of Indigenous Communities).

Forest definition for the REDD+ program

In implementing the Cambodia REDD+ program, forests are defined in the following manner:

> *"Forest" under the REDD+ program refers to the unit of the ecosystem in the form of wetland and dry land covered by natural or planted vegetation with area coverage of at least 0.5ha, height more than 5 meters, and canopy crown cover more than 10%.*
>
> *Other areas included in the REDD+ program are forest regrowth and areas under afforestation or reforestation. Rubber, oil palm plantations and perennial crops are excluded from this definition.*

3.4. Land use/cover mapping

Methodology

Since the 2002 Forestry Law, the Forestry Administration has been responsible for assessing forest cover every four years. On-screen digitizing techniques were introduced to produce the 2002 forest map and LANDSAT images were the primary sources of the satellite data that were used in producing the 2002, 2006, and 2010 assessments.

In 2014, image segmentation software was introduced through a series of trainings on the use of those techniques. Image segmentation was subsequently used to stratify Non-Forest and Other Forest areas of the 2006 and 2010 cover maps, as well as to produce the land use/cover map for the 2014 epoch.

Land Cover classifications

Forest cover assessments have been prepared for the 1965, 1992/93, 1996/97, 2002, 2006 and 2010 epochs. Evaluations of the accuracy of those assessments have only been

performed on the 2006 and 2010 forest cover maps, however. As a result, although those two epochs would have been considered to be suitable for calculating FRELs, rubber and oil palm plantations, which are excluded from the definition of forest used for REDD+ activities, were not separated from the classification of forests on the map. Moreover, the non-forest area was also not stratified.

It is for this reason that details of land use/cover classes were reviewed to define a new series of classes suitable for REDD+ that would also be compatible with IPCC's six land use/cover classes. Table 2 compares the relationships between the 'old' classes and the 'new' classes, which are defined in Annex III. The revised set of land use/cover classes was used to upgrade the 2006 and 2010 maps and to produce the 2014 map.

	Old categories		New categories
1	Evergreen forest	1	Evergreen forest
2	Semi-evergreen forest	2	Semi-evergreen forest
3	Deciduous forest	3	Deciduous forest
4	Bamboo	4	Bamboo
5	Wood shrub Dry	5	Wood shrub
6	Wood shrub evergreen		
7	Other forest	6	Mangrove forest
		7	Rear mangrove
		8	Rubber plantation
		9	Flooded forest
		10	Forest regrow
		11	Pine tree
		12	Pine plantation
		13	Oil palm
		14	Tree plantation
8	Non-forest	15	Paddy field
		16	Crop Land
		17	Grassland
		18	Built-up area
		19	Village
		20	Rock
		21	Sand

		22	Water

Table 2. Comparison of 'old' and 'new land use/cover classes¥.

3.5. Forest inventory survey

Current situation

The FA has conducted forest inventory surveys for various purposes, including the collection of timber volume data in forest concessions and for developing assessments of forest resources in Economic Land Concessions (ELCs), community forests, REDD+ project areas, and forest plantations, as well as for project research. Forest inventory data covering the entire country do not exist, however, and are not publicly available. The FA and the MoE have not conducted comprehensive surveys of the country's forest biomass.

Data availability

There are some of the results of the forest inventory surveys that have been undertaken that are available, while some of that data are still in the process of compilation and validation and are not readily accessible. The forest inventory survey results which are available were compiled by FAO (2015 unpublished). Annex II presents a part of the results of that compilation.

3.6. Information collected from local offices and communities

The FA is organized into 4 inspectorates, 21 cantonments, 55 divisions and 170 triages. Information from local offices is transmitted to the central office by means of one of the following three routes.

- Monthly reports from Inspectorates ➔ Department of Administration, Planning, and Finance.
- Monthly reports from Protection Forests ➔ Department of Wildlife and Biodiversity Conservation.
- Reports on illegal activities ➔ Department of Legislation and Law Enforcement.

The comprehensive list of subjects that is reported on in the monthly reports is enumerated in Annex V. The primary subject matter covered in these reports includes:

- Forest demarcation, classification and registration.
- Forest community development.

- Timber and non-timber product management.
- Tree plantation development and silviculture.
- Wildlife and biodiversity conservation.
- Forest industry, commercial development and management.
- Capacity building.
- Forest law enforcement.

The FiA and GDANCP in the MoE have similar reporting mechanisms.

A "Preliminary Investigation Report", the reporting format used for a Case Tracking System in the FA, is presented in Annex IV. That report is designed to collect information on illegal forest activities through the disposition of cases on forest crime that are stored in a national database. While this system is not currently operative, the report format might be used effectively as one of the bases to develop an even more comprehensive reporting format.

3.7. Data management

The FA has a mandate to manage and store the map data in the FA database. There is no office or department that has yet been mandated to manage the forest inventory survey data.

Database system

A database management system was developed to improve data management. Land use/cover maps produced by the FA are now stored in the digital database operated by the REDD+ Taskforce Secretariat. A Windows-based computer server was selected for the management of data collected from REDD+. The system was developed to be compatible with both commercial GIS software such as ArcGIS, which is familiar to most of the MRV team members, and open-source GIS software, especially QGIS, which is increasingly used in Cambodia.

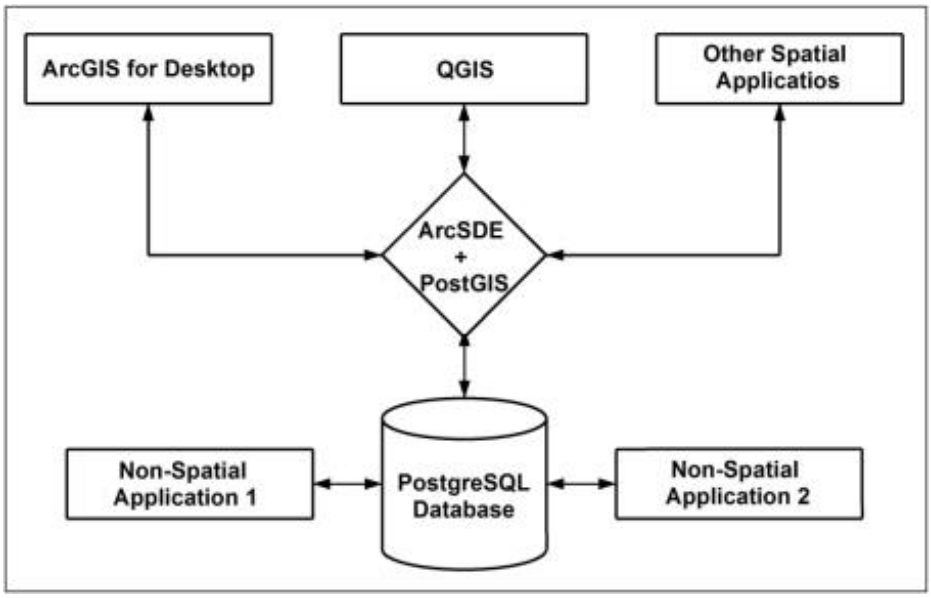


Figure 2. Conceptual design of the NFMS database management system.

The information collected from monitoring illegal forest activities that is incorporated into reports from local offices to the central office and used to initiate appropriate deterrent actions is not yet stored in a systematic manner in the FA, FiA or GDANCP. There are also reporting mechanisms to monitor conditions in community forests that are currently in the process of design.

List of collected data

The MRV team has identified and created a list of potential data to be used for REDD+ and collected some datasets from various government agencies and relevant NGOs.

The design of the WEB platform that will provide information on REDD+ activities that is currently under development is provided in Figure . Initial training on the management of the WEB site and database has been provided to officials of the FA, FiA and GDANCP.

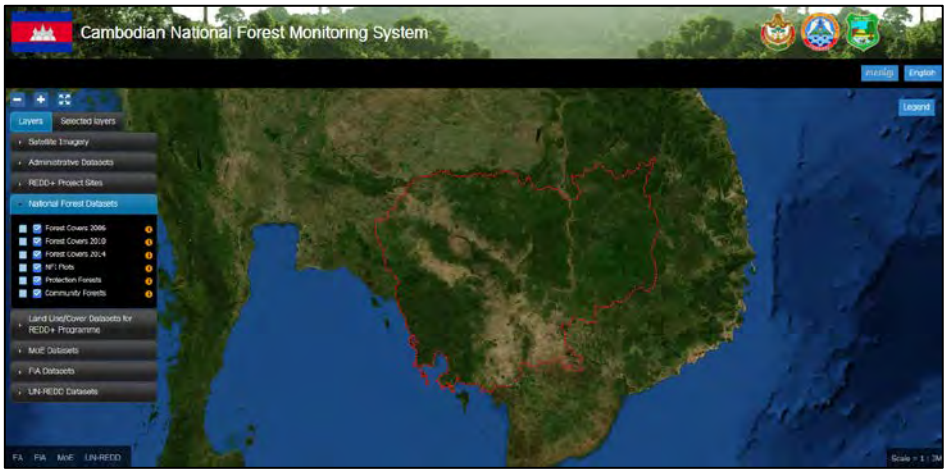


Figure 3. Design of the WEB site of the Cambodia NFMS.

Chapter 4. Principles of NFMS Development in Cambodia

Cambodia has adopted the following set of principles to guide the development of its NFMS.

Multiple benefits:

The NFMS must extend beyond carbon and become a multi-functional instrument used to serve sustainable forest management, as well as programs and activities of the NFP, the National Protected Areas Strategic Management Plan (NPASMP) and the SPFF.

National ownership:

Cambodia must retain control of every NFMS-related process and be solely responsible for the implementation of the NFMS.

International organizations or foreign institutions may support the NFMS program through the strengthening of technical capacity and the development of institutional capacity.

Autonomy:

The NFMS must be developed according to national circumstances, capabilities and priorities. Institutional arrangements must be based, whenever possible, on existing institutions, with the creation of new institutions arising only as the result of necessity.

Operations:

The NFMS should be funded through the state budget and the managers of activities should seek out the most cost-effective solutions at all stages and structural levels.

Centrally coordinated, standardized and scalable top-down system:

Institutions responsible for the implementation of the NFMS should define standardized methodology protocols and agree supply plans with data suppliers.

Compliance with IPCC

The NFMS must be compatible with the most recently adopted or recommended IPCC Guidance and Guidelines, as well as with relevant COP decisions.

Phased approach:

Cambodia intends to obtain the Tier 2 or higher level associated with greenhouse gas (GHG) inventories that includes assessments of 5 carbon pools and to develop its NFMS using a phased approach that will be synchronized with the three phases of the REDD+ program presented in Figure 44.

Chapter 5. Conceptual design of the NFMS in Cambodia

5.1. Composition of the NFMS

Figure 3 depicts the planned composition of the NFMS. It will have two interrelated functions – the MRV Function and the Monitoring Function.

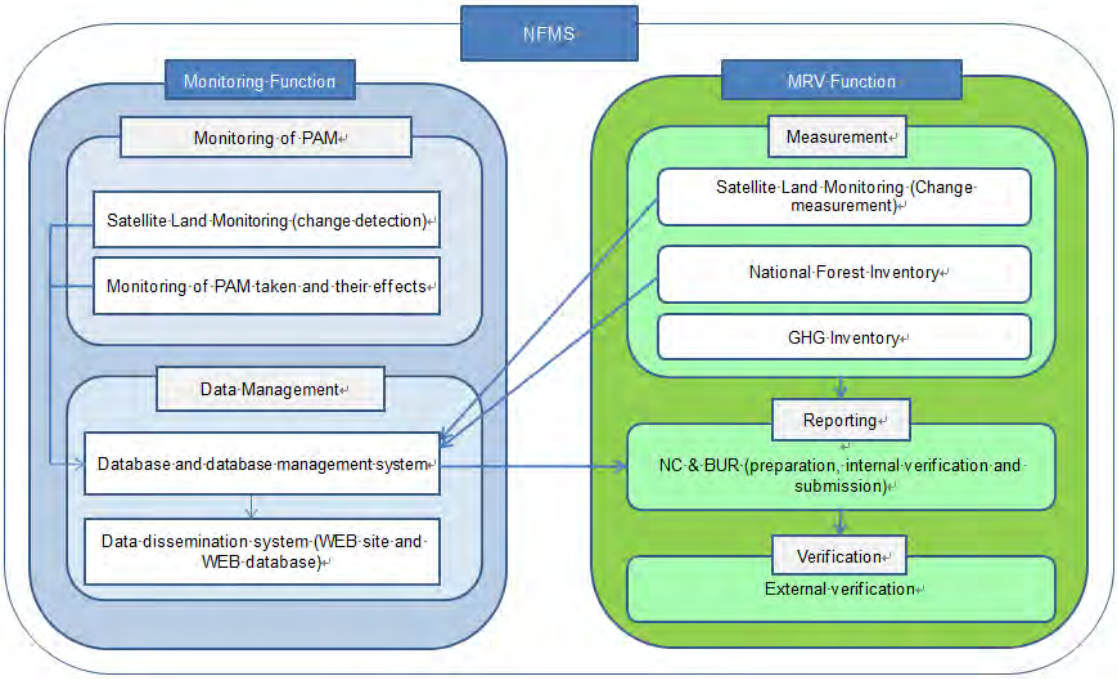


Figure 3. Planned composition of the NFMS in Cambodia.

MRV Function

The MRV Function is divided into three elements, Measurement, Reporting and Verification.

Measurement involves obtaining reliable data from Satellite Monitoring, the NFI and the GHG Inventory. Satellite monitoring will measure land use/cover changes used to obtain Activity Data (AD), while the NFI, which is designed to obtain forest biomass information, will be used to determine the Emission Factor (EF). It is on the basis of the determination of the AD and the EF that the GHG inventory will be conducted.

The data and outputs of the measurements will be used to inform the development of policies and measures (PAMs) to strengthen sustainable forest resources management.

Reporting and Verification provides the means for compiling the results of the measurements to report to the UNFCCC. Verification is comprised of two interconnected steps, internal verification of results by Cambodia followed by international verification of those results by the UNFCCC.

Monitoring Function

The Monitoring Function is concerned with monitoring REDD+ activities and policies and measures to address drivers of deforestation and forest degradation. It consists of a monitoring component and a data management component, the latter of which is further divided into database management and dissemination (publication) parts. Monitoring information will be obtained from external, as well as internal, sources.

5.2. Phased Approach

The NFMS will be developed in a phased approach that is synchronized with the implementation of the three phases of the REDD+ program, which is depicted in Figure 4. The criteria that will be used to guide the development through each of these phases include UNFCCC requirements, national policies, the availability of data, operational costs, and the capacities of users of the NFMS to operate the system and use the information provided in a meaningful manner.

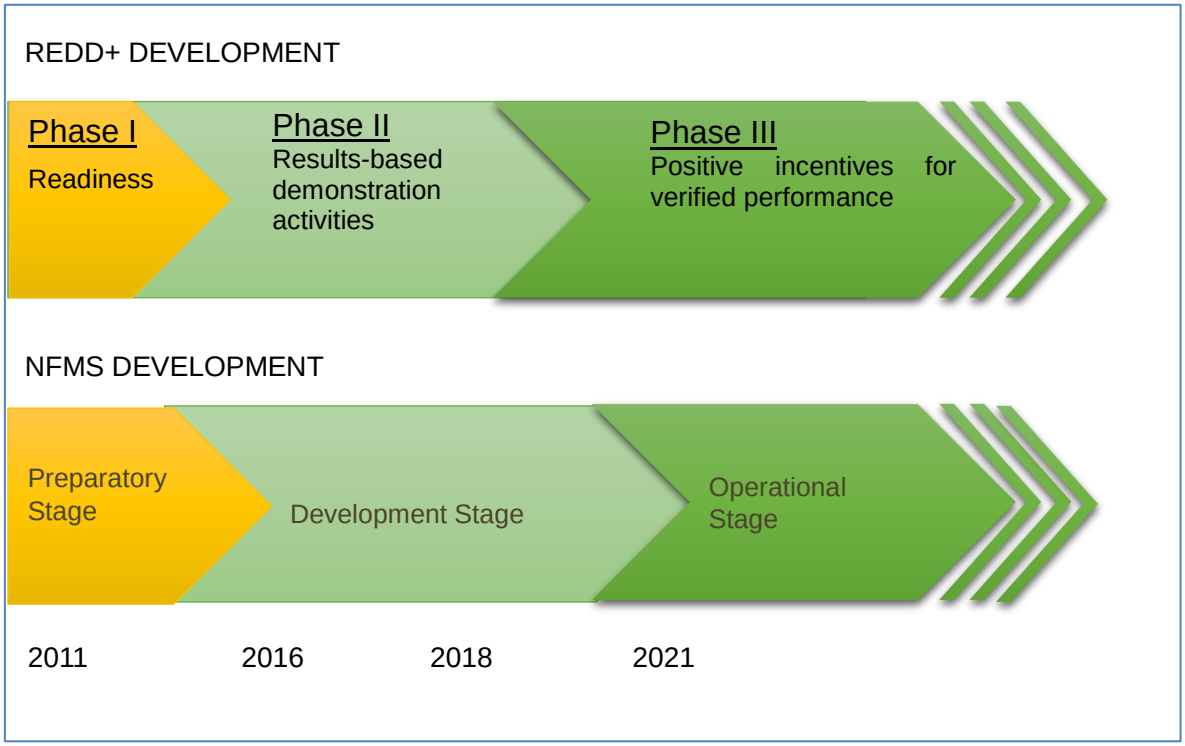


Figure 4. Phased approaches of the development of the Cambodia REDD+ program and the NFMS in Cambodia.

The conceptual basis and primary activities of each of the development phases of the NFMS are presented below. The detailed descriptions of each of those activities are provided in Chapter 6.

Phase I (Preparatory Stage) - (2011-2015)

Cambodia initiated its REDD+ readiness activities in 2011. The primary activities during this phase have been associated with the design of the NFMS and the strengthening of the capacities of government officials.

The primary accomplishments during this phase as of the end of November 2015 include:

- Development of a new satellite monitoring system by introducing an improved methodology for land use/cover mapping to detect land use/cover changes between different land/use cover classes.

- The updating of 2006 and 2010 maps and the production of a new 2014 map by using the developed mapping methodology, which involves the *implementation of the Satellite Land Monitoring System (SLMS)*
- Development of the design of the national forest inventory. (In progress).
- Assessments of GHG inventory methods to guide the selection of either the Gain-Loss or the Stock Difference methods. (*The selection has not yet been made.*)
- Establishment of a database management system and a WEB interface supporting REDD+ in Cambodia. (The construction of the *WEB site is in progress.*)

<u>Phase II Development Stage - (2016-2020)</u>

Phase II will involve further development of the NFMS, including, especially, the design and testing of methodologies and mechanisms of the NFMS established in Phase I. Some components of the NFMS will be implemented during this phase, as well.

(1) 2016-2017

The next cycle of land use/cover mapping using satellite images will begin in 2016. The development of the NFI, starting from the completion of its design and the preparation of a field manual, will continue in 2016 with the preparation of an action plan and the provision of practical training for officials of local offices. In 2017, the implementation of the NFI will be initiated on a relatively small scale and the GHG Inventory for the reporting year of 2014, representing the third National Communication (NC) or the first Biennial Update Report (BUR), will be implemented, using the AD acquired from past satellite monitoring and the EF calculated on the basis of the results of past studies.

There will be an action plan developed for monitoring PAMs, as well, that address drivers of deforestation and forest degradation. Most of the PAMs listed in the National REDD+ Strategy (NRS) of Cambodia will be monitored with reference to documentation that will include relevant laws and decrees, while those PAMs with numerical targets, and the progress of REDD+ activities, will be monitored on the basis of quantitative measures.

In parallel with the identification of monitoring indicators for PAMs, an improved mechanism for collecting monitoring information from local offices and the central office will be evaluated.

Data entry into the database will also be initiated during this phase and the design of the WEB interface will be completed and be made operational.

(2) 2018-2020
During the transition from the second phase to the third phase, activities will be developed in accordance with current conditions and capacities, as well as the state of development and implementation of the NFI.

The succeeding cycle of land use/cover mapping will be conducted while the first cycle of the NFI continues. The GHG Inventory for the fourth NC or the second BUR will be conducted until completion. A revised AD obtained through Satellite Monitoring and a revised EF obtained from the first NFI will be used.

Phase III (Operational Stage) - (2021 -):
In this phase, the data management system will be operational and all of the designed items will be monitored and reported. Information required for the development of the PAMs and the Safeguard Information System (SIS) will be provided, as well, and the PAMs will be monitored.

Satellite Monitoring will be periodically conducted on a two-year cycle. The NFI will enter into its second cycle, reflecting the experience accumulated in the first cycle. The GHG Inventory will utilize the data from the two NFI cycles as EFs to detect forest degradation. The revised AD from Satellite Monitoring will also be available. Monitoring will be conducted with full specification and data management functions.

5.3. Relation with other activities

Although the NFMS of Cambodia will be developed as an independent system, it will be related to other activities, as well, and linked to those activities such as the SIS. The

information that will be required by the SIS and provided through the NFMS – particularly through its Monitoring Function - will be determined in concert with the development of the SIS to avoid duplication in the functions and nature of the information that will be managed.

Chapter 6. Development of NFMS Components

As it was previously explained, Cambodia has monitored the distribution of forest areas using satellite-based forest cover maps. Furthermore, various types of forest inventory surveys have been conducted. The initial National Communication was submitted to the UNFCCC in 2002. Therefore, Cambodia has the foundation for the development of a national forest monitoring system.

The required modifications of the current forest monitoring mechanism in Cambodia include:

- Expanding in a systematic manner the targets of forest inventory surveys to encompass all of the forest types in the country.
- Developing a mechanism to collect information other than that directly related to the measurement of carbon and the area of forests.
- Establishing procedures to improve the management and dissemination of data.

6.1. MRV function

6.1.1. Satellite Land Monitoring System (SLMS)

6.1.1.1. Purpose

The SLMS has two purposes, one of which is to provide Activity Data for the MRV function and the second which is to provide information for land use/cover classes change detection between class categories.

6.1.1.2. Scope

Target activity

In recognition of current technological limitations, the detection of land use change, including deforestation, will be the initial target. The detection of changes occurring in a land use/cover class, or forest degradation, will be subject to continued technological advances.

Measurement cycle

The FA will update land use/cover maps (data) every two years. The upgrading of the map content will also be considered.

Methodology:

The FA has used land use/cover maps in vector format to monitor land use and cover over an extended period of time. Land use/cover maps in vector format were produced because the boundary line of each land use/cover class was required for forest management purposes. In 2014 and 2015, however, segmentation was used to produce the 2014 land use/cover map. Technical details of the mapping process are summarized in Annex IV.

Freely available LANDSAT 8 images will be used to produce land use/cover maps since high resolution satellite images are currently prohibitively expensive. Changes occurring inside forests are difficult to detect on medium resolution images such as LANDSAT 8, however, and, as a result, only land use change, including deforestation, will be the initial target of detection.

6.1.1.3. QA/QC measures

For quality control, QC, manuals providing detailed explanations of the operation of software and procedures have been prepared. For quality assurance, QA, accuracy assessment of a map of one epoch has been established. The methodology to use to assess the accuracy of land use/cover change will be developed.

6.1.1.4. Development Plan of SLMS (2016-2018)

(1) Revision of current mapping techniques.

Preparation for the next cycle of mapping will be initiated, including review of the mapping technique introduced for the 2014 mapping.

(2) Exploration of techniques to detect different carbon stock levels.

The exploration of cost effective methodologies to detect forest degradation other than that caused by land use change will be conducted, as will assessments of the techniques to stratify forests according to different carbon stock levels.

(3) Exploration of techniques to assess the accuracy of land use/cover change.

(4) The further strengthening of the capacities of FA officials in satellite image interpretation and analysis.

6.1.2. National Forest Inventory

6.1.2.1. Purpose

The National Forest Inventory will be implemented to obtain precise information on biomass volumes of forests of different types, ages, densities and locations. The data collected will be used to calculate emissions and removals of forest carbon. Prior to the completion of one cycle of NFI, the EF will be obtained from existing studies.

6.1.2.2. Scope

Target carbon pool:

Each of the 5 carbon pools, including 'above ground biomass' (AGB), 'below ground biomass' (BGB), 'dead wood', 'litter' and 'soil organic matter,' will be targeted.

Implementation Cycle:

The implementation cycle will be four to five years.

Methodology

Permanent Sample Plots (PSPs) will be distributed in forested areas using stratified systematic sampling methods. Different point densities will be applied for upland forest stratum, inundated forest stratum, and mangrove stratum, as presented in .

Stratum	Area (km^2)	Number of sampling plots (clusters) expected in forest or other woodland
Upland	152,751.3	2,751
Wetland	27,742.0	322
Mangrove	1,207.6	97
Total	181,701.0	3,170

Source* FAO (2014).

Table 3. Number of Permanent Sample Plots in each stratum.

Data to be collected

Biomass data, including diameter and height, are principal targets. Conditions of forest in and around the plots will also be described to improve understanding of

ecological and socio-economic conditions.

6.1.2.3. QA/QC measures

A documented field manual was developed for the standardization of survey methods. The manual increases the understanding of survey methods for survey personnel and contributes to the reduction of survey errors. Sampling surveys will be conducted in 5% of the surveyed plots. There will be an independent QA/QC team comprised of specialists, who are responsible for re-measuring the plots to ensure the quality of the measurements of the field team and to provide appropriate feedback to improve data quality.

6.1.2.4. Development plan of NFI

(1) 2016-17

It is expected that detailed design and practical training will be organized in 2016 and that implementation will start in 2017 on a small scale. Reflection on the experience gained and subsequent adjustments will facilitate the full-scale operation of the NFI in succeeding phases.

(2) 2018-21

The first cycle of the NFI will be conducted until it has attained sufficient Quality Control because it will be the first large scale forest inventory survey organized in Cambodia.

(3) 2022 -

The second cycle of the NFI will start after the design and methodology of the initial NFI have been reviewed.

6.1.3. GHG Inventory for Land use and Land Use Change and Forestry Sector

6.1.3.1. Purpose

The purpose of the national GHG inventory is to estimate and report on the climate change mitigation impacts resulting from the implementation of REDD+ activities.

The national GHG inventory will utilize standard international templates and be developed using the Good Practice Guidance of the Intergovernmental Panel on Climate Change (IPCC). It will be reported to the UNFCCC Secretariat on a

regular basis.

The mitigation results reported through the GHG inventory will form the basis for results-based payments for REDD+ once the results have undergone a process of verification through International Consultation and Analysis (ICA).

6.1.3.2. Scope

Target carbon pool:

Of the five carbon pools, AGB and BGB will be targeted because of the state of current data availability of Tier 2 level data. Dead wood, litter and soil organic matter will be included after the initial NFI has been completed.

Target activities:

Deforestation," plus "conservation", "sustainable management of forests" and "enhancement of forest carbon stocks," will be targeted. "Forest degradation" will not be included until the fully-operational phase in which efficient EFs over two periods have been obtained.

Target GHG:

CO_2 will be targeted while CH_4, CO, N_2O, NOx will not be included. "Biomass burning," which is the principal source of non-CO^2 GHG in the LULUCF sector will not be included in the inventory until required data (e.g., area burned, amount burned, etc.) become available. Since organic soil, which is the other sink/source of non-CO2 GHGs, has very limited distribution in Cambodia and is not a significant sink/source, it will not be considered.

Tier level:

The tier level will be Tier 2 with country-specific ADs and EFs.

GHG Inventory Cycle:

GHG inventory will be repeated in the same cycle of the NC and BUR submission.

Methodology:

The Gain-Loss method was used in preparing the first and second National Communications of Cambodia. Since the aim is to raise the tier level from 1 to 2,

however, the continued use of the Gain-Loss method would be constrained because of the difficulties of collecting the number of country- or regional-specific data required to use that method. There is also an important consideration regarding the use of the Stock Difference method because in order to use it, the EF could only be obtained after two cycles of the NFI would have been completed. The selection of the method will be determined in the process of preparing the first BUR, which is planned to be submitted in 2018. Subsequent to completion of two cycles of the NFI, the use of the Stock Difference method may be considered.

6.1.3.3. Development plan of GHG Inventory

(1) Initial Phase: (2016-2017)

The GHG Inventory will be conducted for the third NC or the first BUR which will be submitted in 2018. The reporting year will be 2014. There will be a series of data sets provided through Satellite Monitoring conducted in 2015 that will be used to determine the AD. The EF will be obtained from existing studies on Cambodian forests.

(2) Transition Phase: (2018-2019)

The GHG Inventory will be conducted for the fourth NC or the second BUR which will be submitted in 2020. There will be a revised AD provided as the result of the new mapping. The EF obtained from existing studies may also be replaced as a result of the new EF that was obtained in the first NFI, although that will depend on the progress of the NFI and the schedule of the GHG inventory.

(3) Fully-operational Phase (2020 -)

The GHG Inventory will be conducted on a regular basis. The ADs determined from Satellite Monitoring will also be periodically accumulating. Two sets or more of EFs obtained from the NFI will be available after the completion of the second cycle of the NFI.

6.1.4. Reporting and Verification

Reporting and review requirements for non-Annex I Parties under the UNFCCC include:

Biennial Update Reports (BUR): These reports, which are submitted biennially, contain information on national circumstances, national GHG inventories, mitigation actions and their effects, constraints and gaps, and related financial, technical and capacity requirements. The reports are subject to International Consultations and Analysis.

National Communications (NC) :

These reports contain information on national circumstances, national GHG inventories, mitigation measures, adaptation measures, vulnerability assessments, constraints and gaps, and related financial, technical and capacity requirements. There is no review process

The reporting and review requirements for non-Annex I Parties under the UNFCCC when implementing and seeking results-based payments include:

Forest Reference (Emission) Levels (FREL/FRL):

These are voluntary submissions used as benchmarks for assessing each country's performance in implementing REDD+ activities. These reports contain information on forest definitions, scope (activities, pools, gases), historical data, ADs and EFs, construction approach, scale, etc. The reports are subject to technical assessments.

Technical annex to BUR (REDD+):

Supplemental information: Non-Annex I Parties may supply a technical annex that includes sector-specific information (e.g., information on REDD+) seeking to obtain and receive payments for results-based actions. The reports contain information on assessed forest reference emission levels, results of REDD+ activities, consistency with assessed forest reference emission levels, etc. These reports are subject to International Consultations and Analysis.

The relationships among map/activity data, national forest inventories, forest reference level establishment and NCs and BURs are summarized in Table 4.

Table 4. Provisional schedule of NC and BUR submissions.

Year	Map/Activty Data		National Forest Inventory		Forest Reference Emission Level			National Communications (NC)			Biennal Update Report (BUR)			
	Data	Production	Data collection	Comple-tion	Baseline	Submissio n	Technical assess-ment	Inventory Year	Prepara-tion	Submi-ssion	Inventory Year	Prepara-tion	Submi-ssion	ICA
2014	•				•			•			•			
2015		•				•				•				
2016	•		•				•		•			•		
2017		•	•						•			•		
2018	•		•		•			•	•	•	•	•	•	
2019		•	•			•						•		•
2020	•		•	•			•		•		•	•	•	
2021		•	•						•			•		•
2022	•		•		•			•	•	•	•	•	•	
2023		•	•			•						•		•
2024	•		•	•			•		•		•	•	•	
2025		•	•						•			•		•
2026	•		•					•	•	•	•	•	•	

6.2. Monitoring Function

6.2.1. Purpose

The Monitoring Function of the NFMS focuses on the effects of policies and measures to address drivers of deforestation and forest degradation. The flow of information between the NFMS and PAMs is interactive. The NFMS provides required information for executing the PAMs and subsequent to the implementation of the PAMs, the NFMS monitors their progress and outcomes. The items to be monitored are determined on the basis of necessity and feasibility.

6.2.2. Scope: The primary activities under REDD+ are deforestation and forest degradation, plus the enhancement of carbon stocks.

Methodology and Monitoring Items

PAMs will be monitored by means of:

(1) Assessments of implemented plans.

Documents describing the contents of policies and measures and budget allocations will be used as evidence supporting the implementation of PAMs. Performance will be monitored by other documented reports, including audit reports.

The current government auditing system will be used to monitor planned REDD+ activities, as well as provide comparisons between allocated budgets and actual amounts spent.

(2) Assessments of outcomes.
The assessments of land use/cover changes will also be used to monitor PAMs. This process will entail the use of satellite images, as well as information provided by local governments, local offices of central government, and local communities. Since the purpose of these assessments is not measurement, the satellite image analyses will be implemented in a shorter cycle than that applied for measurement.

1) Satellite monitoring:
Land use/cover maps will be produced every two years. Considering recent changes in land use/cover, however, it will be useful to supplement that coverage by monitoring land use/cover change on a more restricted schedule.

The SLMS will also be used to provide regular updates on land use/cover conditions to support the Monitoring Function. The information provided from local offices and local government will be merged with that derived from satellite images to increase the reliability of monitoring.

2) Monitoring using information collected from local areas:
In principle, details of the targets to be monitored will be determined according to the PAMs that have been selected.

If a PAM is measurable, such as the demarcation of a forest boundary or the establishment of community forestry projects, it will be monitored by measuring the length of demarcated boundary or the number of new community forest projects, respectively, that are recorded on documents or reports.

Information from local areas is a critical consideration with regards to monitoring situations affecting REDD+ activities. The maintenance of open lines of communication between central and provincial governments is essential to ensure the successful outcomes of REDD+ activities and the NFMS. There will be a mechanism established to collect information on forest conditions from provincial

governments in each province. The effectiveness of that process will depend on the central government's commitment to providing provinces with the information required to support improved forest management in the provinces.

There will be regular reporting from local offices of the FA, FiA and MoE. The current procedures of reporting will be revised as might be required and the establishment of an exclusive reporting process for MRV will be under consideration.

The impacts of PAMs on local communities and biodiversity will also be monitored by means of the establishment of a well-coordinated group of government officers, members of academia, and representatives of NGOs and local governments and communities.

Scale of Monitoring

Monitoring will be implemented at two different scales, that of the entire country and that of REDD+ activity areas that require more intensive monitoring.

Monitoring the entire country will require:

- Early detection of nation-wide land use/cover changes.
- The use of low to medium resolution satellite images that may be acquired without cost.
- The use of software to obtain image analyses combined with information collected from local offices to identify significant land use/cover changes.
- The periodic updating of land use/cover maps.

Monitoring of REDD+ activity areas will require:

- Intensive monitoring of the effects of PAMs in specified areas.
- The use of medium to high resolution satellite images depending upon the available budget.
- The use of the results of image analyses combined with information collected from local offices to confirm the findings.

6.2.3. Development Plan

(1) Development phase: (2016 –2020)

While detailed elements of monitoring cannot be determined until the action plan of the NRS has been developed, the following preparatory actions are able to still be implemented:

- The revision of the current procedures for reporting from local offices to the central offices of the FA, FiA and MoE to ensure the full utilization of the information contained in reports.
- The design of an effective system of information transmission between local governments and the central offices of the FA, FiA and MoE related to REDD+ activities.
- The strengthening of the capacities of local offices on the use of satellite images for monitoring and the subsequent initiation of satellite monitoring activities.
- The selection of appropriate indicators for monitoring those PAMs that have been determined and the initiation of the monitoring of those PAMs.

(2) Full implementation phase (2021-)
Full scale monitoring will be initiated in this phase.

6.3. Data Management System

6.3.1. Functions of the data management system

The data management system has two functions, data storage and data dissemination. The data required for monitoring and for conducting GHG inventories and preparing reports will be stored in the database management system. The database management system will be dedicated to the use of government officials responsible for managing NFMS activities.

6.3.2 Dissemination of data

The dissemination of data will ensure that stakeholders have access to relevant data and information associated with REDD+ activities. That will be accomplished by means of a website that has been developed for sharing information and that will include land use/cover changes and accompanying statistics. The specific sorts of data that will be provided through the website are currently under discussion. The FA will be responsible for uploading data into the data management system.

6.3.2. Phased development

By the end of 2015, the database management system will have been designed. It will be populated in its initial stages with the data that is most easily obtainable.

The WEB site for data dissemination is expected to be completed in 2017.

6.4. Institutional arrangements

6.4.1. Institutional arrangements for MRV

The institutional arrangements for the MRV component of the national forest monitoring system are illustrated in Figure 5. The principal institutions that will be involved in the coordination and management of the monitoring system include the FA, FiA and GDANCP.

The FA will lead the effort associated with wall-to-wall map production while the three organizations cooperate in the mapping of the country's mangrove and flooded forest areas.

The NFI, including data processing activities and required laboratory analyses, will be implemented collaboratively by the FA, FiA and MoE for forested areas under their respective jurisdictions. The accumulated biomass data of all of the forest areas of the country will be reviewed by the MRV/REL Technical Team to ensure consistency and revisions will be made by each of the respective organizations.

The involvement of domestic research institutes will be encouraged, depending on the sorts of information to be collected.

The tasks of each party involved in the MRV component of the NFMS, and the procedures for implementing MRV activities, will be formalised through institutional arrangements to ensure the long-term sustainability and accountability of the system.

6.4.2. Institutional arrangements for monitoring

The central government will use the same mechanism presented in Figure 5 for monitoring. Each of the agencies will be responsible for monitoring activities implemented in their respective area of jurisdiction.

There will be amechanism developed to exchange information between the central government, local governments, local offices of relevant government agencies and local communities. The tasks of each party involved in the monitoring component of the NFMS, and the procedures for monitoring, will be formalised through institutional arrangements to ensure the long-term sustainability and accountability of the system.

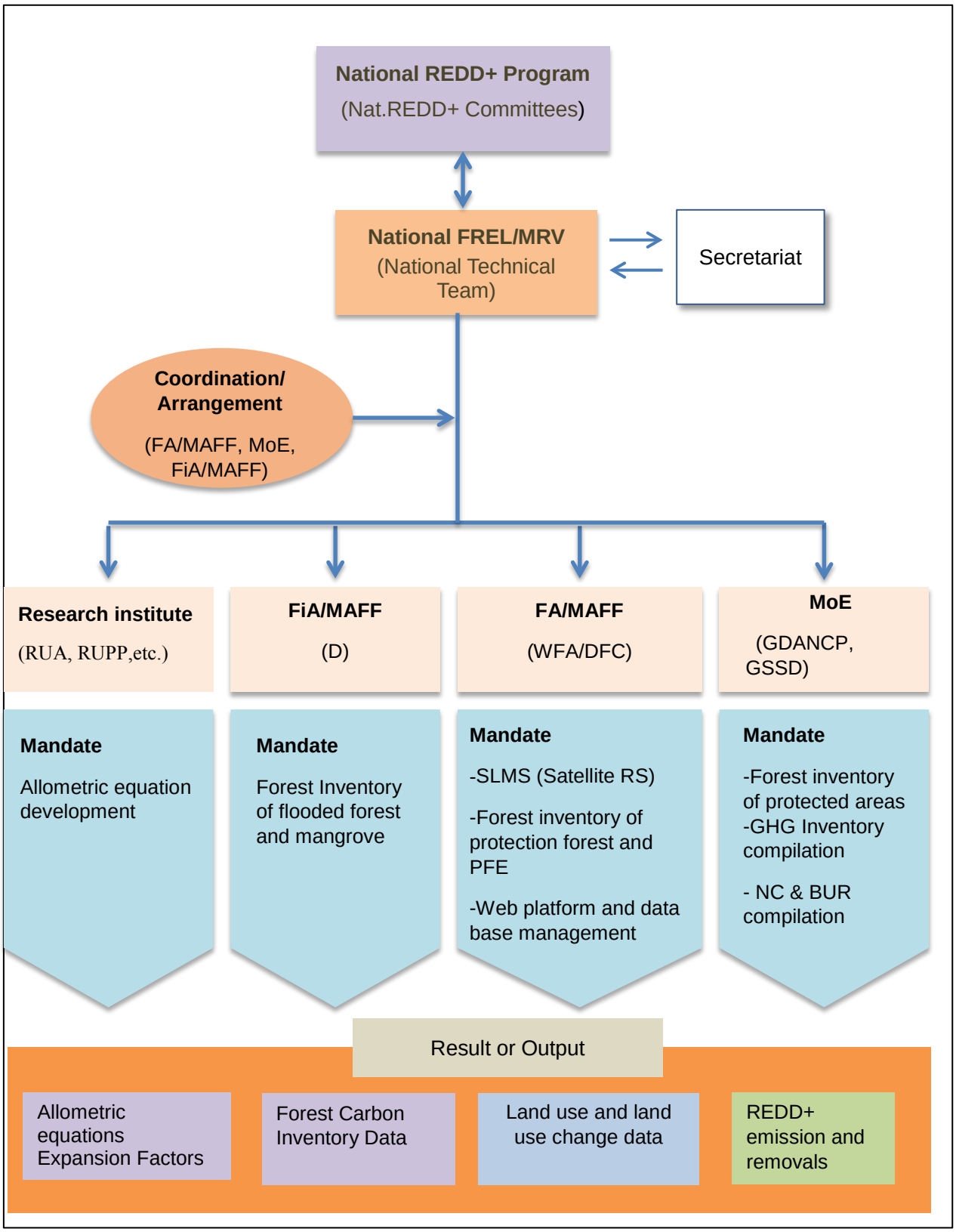


Figure 5. Institutional arrangement for the implementation of MRV.

Chapter 7. Capacity Building

The series of lectures, workshops and on-the-job training programs that have been provided during this initial phase of NFMS development have increased the capacities of officials on forest monitoring to a significant extent. There are still some areas in which further training is required, however. Those areas include:

- Accuracy assessments of land use/cover change.
- Forest inventory surveys.
- Monitoring PAMs.
- Management of the database system and WEB site.
- Overall management of the NFMS.
- GHG Inventories for the LULUCF sector.

It is expected that this additional capacity building will be organized in 2016 and 2017. The capacity building with regard to “accuracy assessments of land use/cover change” and “monitoring PAMs” will be conducted only after the methodologies have been completely developed, with the exception of the detection of land use/cover change using satellite images.

Chapter 8. Cost Considerations

The costs of the major elements associated with developing and implementing the NFMS are estimated in Table.

	Activity and Cost Items	Unit cost	Quantity	Cost
1	Satellite Land use/cover mapping			
1.1	Pre-processing			
1.1.1	Personnel cost			
2	Accuracy verification survey			
2.1	Personnel cost			
2.2	High resolution satellite image			
2.3	Travel cost			
2.3	Field survey cost			
3	National Forest Inventory			
3.1	Field work			
3.1.1	Personnel cost			
3.1.2	Travel cost			
3.1.3	Field survey cost			
3.1.4	Equipment cost			
3.2	Indoor work			
3.2.1	Personnel cost			
3.2.2	Laboratory test – litter			
3.2.3	Laboratory test - soil			

SLMS

Activity	Cost	Remarks
1. Image Interpretation	$350,000-$400,000/each cycle	
2. Accuracy assessment of map and land use/cover change	$250,000/each cycle	
3. Capacity to improve the effective of tasks	$40,000	
4. Workshop and publication	$20,000/each publication	
5. Capacity Building		
5.1 Long term such as studying for master's degree	$65,000/person × 3-4 persons	
5.2 Short course trainings	$60,000/course	
5.3 Training workshop at different levels	30,000/workshop /year × 2 years	

NFI except litter and soil survey

Activity	Cost	Remarks
Field survey (One cycle	US$6,500,000 (4-5 years)	
Field survey (Future)	US$1,000,000/year	

Litter and soil survey and analysis

Activity	Cost	Remarks
1 For Personnel for soil and litter sampling in the field	0	
2 For procuring equipment for soil and litter sampling	US$4,104	
3 For laboratory work for litter analysis	US$2,000	
4 For laboratory work for soil analysis	US$4,718	

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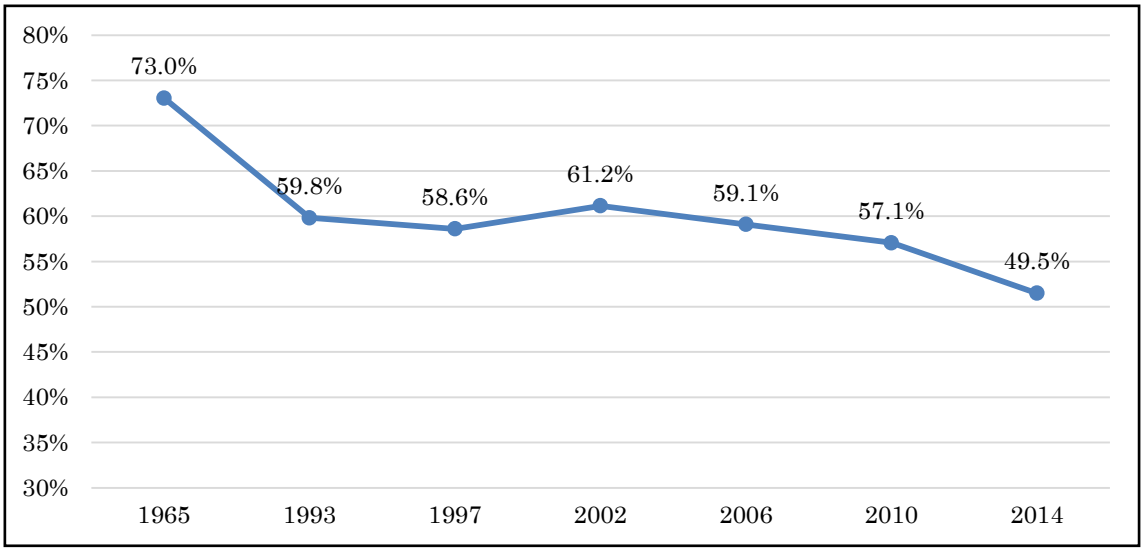
Annex I

Historical change in forest cover of Cambodia.

(1965, 1992/93, 1996.97, 2002, 2006, 2010, and 2014)



Annex II

Plot characteristics of various forest inventories in Cambodia.

Institution	Project	Plot shape	Nested	Level 1 Condition	Level 1 shape	Level 1 area (ha)	Level 2 condition	Level 2 shape	Level 2 area (ha)	Level 3 condition	Level 3 shape	Level 3 area (ha)	# of plots	# of trees	Min DBH (cm)	Max DBH (cm)	Tree height
WA	Cardamom	rectangle	Yes	DBH >= 30 cm	25x200m (twice)	1	DBH: 5 - 29 cm	10x25m (twice)	0.05	DBH <= 5 cm	10x6m (twice)	0.012	105	20124	1	462	Sample
CFMP-FAO	All	rectangle	yes	DBH >= 30 cm	50x100m	0.5	DBH: 10 - 29 cm	50x50m	0.25	DBH <= 10 cm	50x25m	0.125	218	16485	2	209	No
CFMP-RECOFTC	Kampong Thom CF	rectangle	yes	DBH >= 30 cm	50x100m	0.5	DBH: 10 - 29 cm	50x50m	0.25	DBH <= 10 cm	50x25m	0.125	79	4904	10	150	Sample
CFMP-RECOFTC	Anh Chanh CF	rectangle	yes	DBH >= 30 cm	50x100m	0.5	DBH: 10 - 29 cm	50x50m	0.25	DBH <= 10 cm	50x25m	0.125	7	753	10	131	No
WCS	Cherndar PV	rectangle	No	No	250x20m	0.5	No	No	No	No	No	No	15	1465	20	150	No
CFMP-FA	All	rectangle	Yes	DBH >= 30 cm	50x50m	0.25	DBH: 10 - 29 cm	25x50m	0.125	DBH <= 10 cm	25x25m	0.0625	40	2717	10	166	Yes
CFMP-RECOFTC	Okrasang CF	rectangle	yes	DBH >= 30 cm	50x50m	0.25	DBH: 10 - 29 cm	25x50m	0.125	DBH <= 10 cm	25x25m	0.0625	57	1419	10	75	No
CFMP-RECOFTC	Okrieng CF	rectangle	yes	DBH >= 30 cm	50x50m	0.25	DBH: 10 - 29 cm	25x50m	0.125	DBH <= 10 cm	25x25m	0.0625	106	3488	10	100	No
FA-PSP	Koh Kong and Siem Reap	rectangle	yes	DBH >= 30 cm	50x50m	0.25	DBH: 15 - 29 cm	20x20m	0.04	DBH < 15 cm	10x10m	0.01	40	1570	7.1	133.4	No
PACT	Oddar Meanchey	rectangle	no	No	50x50m	0.25	No	No	No	No	No	No	151	12063	2.5	200	No
PACT	Siem Reap	rectangle	yes	DBH >= 20 cm	25x25m	0.0625	DBH: 5 - 19 cm	15x15m	0.0225	DBH <= 5 cm	10x10m	0.01	51	1949	1	124	No
CFMP-GERES	All	rectangle	Yes	DBH >= 30 cm	20x30m	0.06	DBH: 10 - 29 cm	10x10m	0.001	DBH <= 10 cm	2x2m	0.0004	350	3648	5	216	No
WCS	Kulen Promtep WS	circles	Yes	DBH >= 30 cm	20m radius (3 times)	0.377	DBH: 15 - 29 cm	15m radius (3 times)	0.212	DBH < 15 cm	5m radius (3 times)	0.024	57	3573	5	190	No
WCS	Preah Vihear PF	circles	Yes	DBH >= 30 cm	20m radius (3 times)	0.377	DBH: 15 - 29 cm	15m radius (3 times)	0.212	DBH < 15 cm	5m radius (3 times)	0.024	61	3523	5	161	No
CI	Prey Long	circles	yes	DBH >= 30 cm	20m radius	0.126	DBH: 15 - 29 cm	15m radius	0.071	DBH < 15 cm	5m radius	0.0079	51	1056	5	143.6	No
WCS	Seima PF	circles	Yes	DBH >= 30 cm	20m radius	0.126	DBH: 15 - 29 cm	15m radius	0.071	DBH < 15 cm	5m radius	0.0079	308	7819	5	217	No
FFI	CCPF	circles	Yes	DBH >= 10 cm	15m radius	0.071	DBH < 10 cm	5m radius	0.0079	-	-	-	71	1476	5	104	No

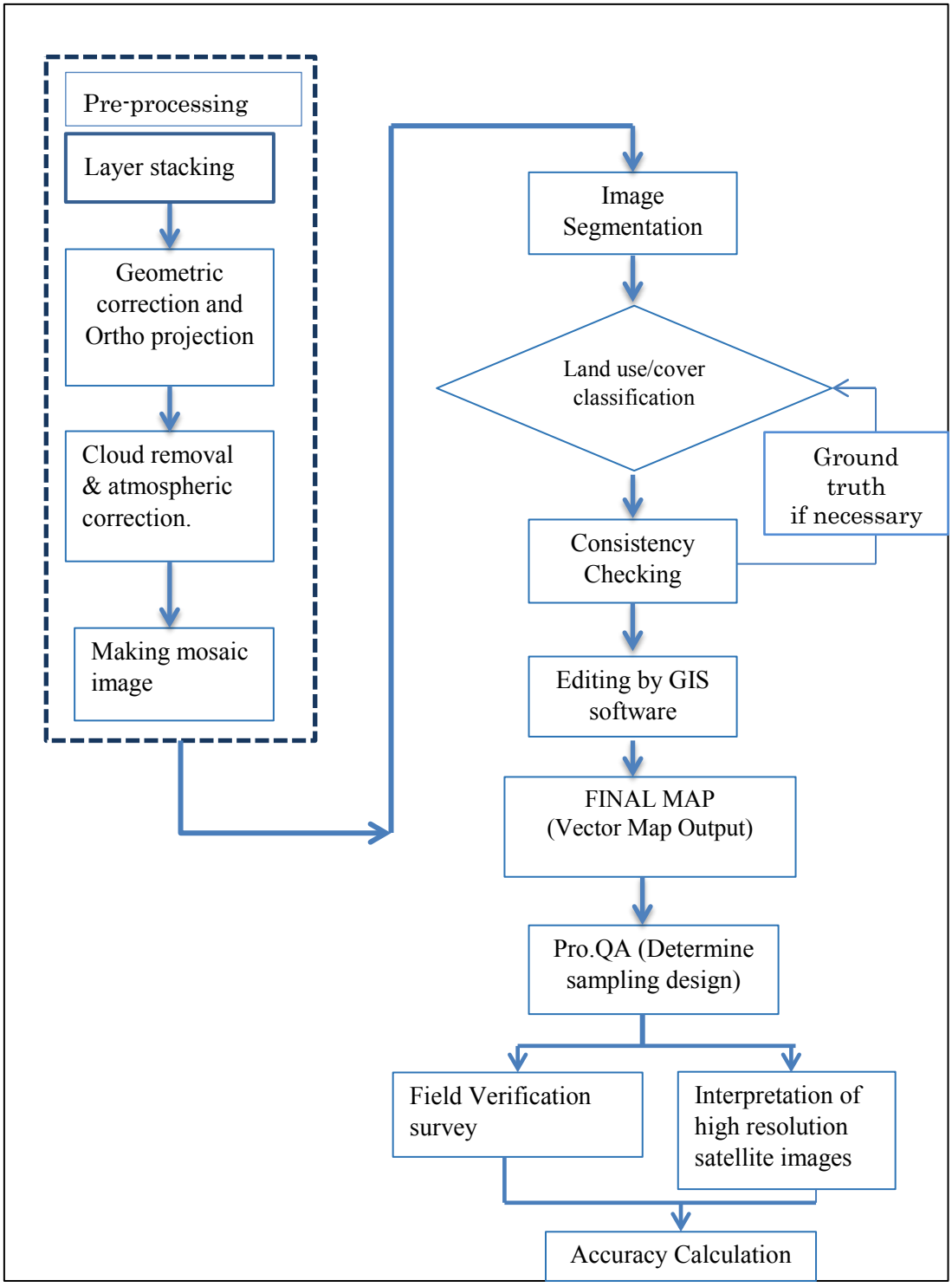
Annex III

Land use/cover classes.

	Land cover class	Description
1	Evergreen forest	Areas covered by trees maintaining their leaves during the whole year.
2	Semi-evergreen forest	Contain variable percentages of evergreen and deciduous trees.
3	Deciduous forest	Comprised of dry mixed deciduous forest and dry Dipterocarp forests
4	Bamboo	Areas dominated by bamboo
5	Wood shrub	Areas dominated by evergreen and deciduous woodland with a height less than 5 meters
6	Mangrove forest	Areas dominated by Mangroves i.e. coastal salt tolerant species
7	Rear Mangrove	Mostly growing in coastal zone after mangrove spp. however, this species also seen growing in some other places which containing soil type of "Podzol"
8	Rubber plantation	Areas currently supporting, and areas reserved for, rubber plantation
9	Flooded Forest	This forest type is found in Tonle Sap Lake. Most of the forests are low and disturbed. In many cases, there is only a mosaic remaining
10	Forest Regrowth	Areas of naturally regenerated forest where there are clearly visible indication of human activities such as selective logging, areas regenerating following agricultural land use, areas recovering from human induced fire, etc. – Include forest where it is not possible to distinguish whether planted or naturally regeneration. – Include forests with mix of naturally regenerated trees and planted/seeded trees, and where the naturally regenerated trees are expected to constitute more than 50 percent of the growing stock at stand maturity. – Include abandoned forest land and bare land which will regrow into forest within ten years
11	Pine Tree	The area dominated by pine tree
12	Pine plantation	The area domunated by pine tree plantation
13	Oil palm	The area dominated by oil palm tree.
14	Tree plantation	This class includes the following type: teak, eucalyptus, acacia, jatropha and others.
15	Paddy Field	Paddy field is a flooded parcel of arable land used for growing semiaquatic rice.
16	Crop Land	This category includes arable and tillage land, and agro-forestry systems where vegetation falls below the thresholds used for the forest land category
17	Grassland	Grasslands are characterized as lands dominated by grasses rather than large shrubs or trees. It is crucial that the rainfall is concentrated in six or eight months of the year, followed by a long period of drought when fires can occur.
18	Built-up area	The patch of land with building and construction
19	Village	The patch of land with houses and garden surrounding house.
20	Rock	Land of naturally exposed rocks or strip mines, quarries and gravel pits.
21	Sand	In general, land of sand having thin soil or sand including deserts, dry salt flats, beaches, sand dunes.
22	Water	Area of fresh and sea water

Annex IV

Scope and Method of Land Use/Cover Mapping.



Minimum mapping unit (MMU):

MMU for existing maps is 25ha. For new mapping, 5ha MMU was used.

Land use/cover classes:

Table 4 shows land use/cover classes that will be monitored, while table 4 shows the relation with IPCC's six classes.

Land Use/Cover Classes for forest monitoring in Cambodia

Class defined in IPCC guideline	Newly defined classes of Cambodia
Forest Land	Evergreen forest
	Semi-evergreen forest
	Deciduous forest
	Forest regrowth
	Pine
	Pine plantation
	Tree plantation
	Mangrove
	Rear mangrove
	Flooded forest
	Bamboo
Cropland	Rubber plantation
	Oil palm plantation
	Agriculture
	Paddy field
Grassland	Grass
Settlement	Built-up area
	Village
Other land	Wood Shrub
	Rock outcrop
	Sandy beach
Wetland	Water

(Page 1.9 of 2006 IPCC Guidelines for National Greenhouse Gas Inventory)

QA/QC measures

Necessary measures, such as logical check of mapping results, have been introduced for

quality control (QC). For quality assurance (QA), map accuracy is verified through an accuracy assessment process. Accuracy assessment points are selected among from planned PSP of NFI. Systematic stratified random method will be used for the selection.

Annex V

ITEMS IN MONTHLY REPORT OF FA.

1. Forest and Forest Community management and development
   - 1.1 Forest Demarcation, Classification and Registration
   - 1.2 Forest Community
   - 1.3 Timber and Non timber Product management
   - 1.4 Practice other work beside

2. Tree Plantation development and Silviculture
   - 2.1 New Plantation and Old Plantation Protection from year 1 to year 5
   - 2.2 Seedling Transplant for providing to local People
   - 2.3 Nursery Preparation and Creation
   - 2.4 Genetic resource development
   - 2.5 Tree Transplant inventory (verify and making map for tree plantation)
   - 2.6 Other work related to development of tree plantation development and private forest
3. Wildlife and Biodiversity Conservation
   - 3.1 Protected Forest and Wildlife Conservation area
   - 3.2 Wildlife Research
   - 3.3 Wildlife Conservation
   - 3.4 Monkey Feeding and Breeding
4. Rescuing, Rehabilitation biological animal breeding and release into natural forest
   - 4.1 Repair and Protect
   - 4.2 Rescue, Take Care, and Protected
   - 4.3 Wildlife improving
   - 4.4 Others
5. Forest Industry, Commercial development and management and International Operation
   - 5.1 International Operation
   - 5.2 Forest Carbon Credit and Climate Change
6. Forest Factor ability improving and researching
   - 6.1 Training
   - 6.2 Researching by using national budget
   - 6.3 Operation with Partner development
7. Forest Law enforcement to contribute to sustainable forest
   - 7.1 Advertising and training of law related to Forest

7.2 Improving Forest law to against Forest crime

7.3 Follow, Check, Verify on Deforestation

7.4 Abstract forest information from news, do research, verify information and take legal action

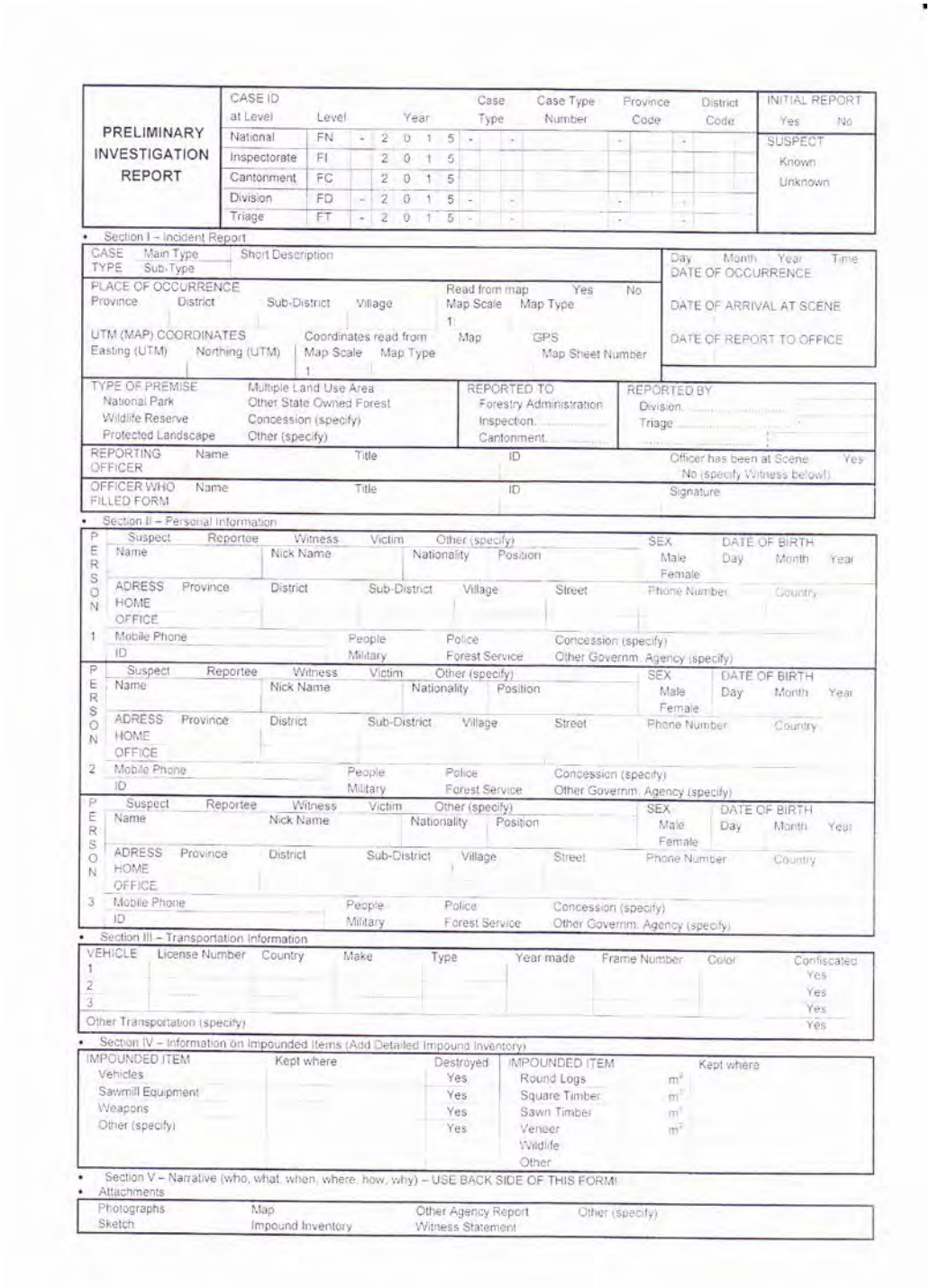
7.5 Examine and Verify forest crime, Wildlife crime, deforestation and Proof the forest crime

7.6 Administer and Encourage forest crime to court

7.7 Prevent and Repress forest Crime, Wildlife Crime and deforestation by forestry

Annex VI

Preliminary Investigation Report for tracking illegal cases.



PRELIMINARY INVESTIGATION REPORT

CASE ID at Level	Level	Year	Case Type	Case Type Number	Province Code	District Code
National	FN	- 2015 -			-	-
Inspectorate	FI	2015				
Cantonment	FC	2015				
Division	FD	- 2015 -			-	-
Triage	FT	- 2015 -			-	-

INITIAL REPORT Yes No

SUSPECT Known Unknown

- Section I – Incident Report

CASE TYPE Main Type / Sub-Type — Short Description

DATE OF OCCURRENCE Day Month Year Time

PLACE OF OCCURRENCE Province District Sub-District Village — Read from map Yes No — Map Scale 1: — Map Type

DATE OF ARRIVAL AT SCENE

UTM (MAP) COORDINATES Easting (UTM) Northing (UTM) — Coordinates read from Map GPS — Map Scale 1: — Map Type — Map Sheet Number

DATE OF REPORT TO OFFICE

TYPE OF PREMISE
National Park
Wildlife Reserve
Protected Landscape
Multiple Land Use Area
Other State Owned Forest
Concession (specify)
Other (specify)

REPORTED TO
Forestry Administration
Inspection
Cantonment

REPORTED BY
Division
Triage

REPORTING OFFICER Name Title ID — Officer has been at Scene Yes / No (specify Witness below!)

OFFICER WHO FILLED FORM Name Title ID Signature

- Section II – Personal Information

PERSON 1
Suspect Reportee Witness Victim Other (specify) — SEX Male Female — DATE OF BIRTH Day Month Year
Name — Nick Name — Nationality — Position
ADRESS Province District Sub-District Village Street Phone Number Country
HOME
OFFICE
Mobile Phone — People Police Concession (specify)
ID — Military Forest Service Other Governm. Agency (specify)

PERSON 2
Suspect Reportee Witness Victim Other (specify) — SEX Male Female — DATE OF BIRTH Day Month Year
Name — Nick Name — Nationality — Position
ADRESS Province District Sub-District Village Street Phone Number Country
HOME
OFFICE
Mobile Phone — People Police Concession (specify)
ID — Military Forest Service Other Governm. Agency (specify)

PERSON 3
Suspect Reportee Witness Victim Other (specify) — SEX Male Female — DATE OF BIRTH Day Month Year
Name — Nick Name — Nationality — Position
ADRESS Province District Sub-District Village Street Phone Number Country
HOME
OFFICE
Mobile Phone — People Police Concession (specify)
ID — Military Forest Service Other Governm. Agency (specify)

- Section III – Transportation Information

VEHICLE	License Number	Country	Make	Type	Year made	Frame Number	Color	Confiscated
1								Yes
2								Yes
3								Yes
Other Transportation (specify)								Yes

- Section IV – Information on Impounded Items (Add Detailed Impound Inventory)

IMPOUNDED ITEM	Kept where	Destroyed
Vehicles		Yes
Sawmill Equipment		Yes
Weapons		Yes
Other (specify)		Yes

IMPOUNDED ITEM		Kept where
Round Logs	m^3	
Square Timber	m^3	
Sawn Timber	m^3	
Veneer	m^3	
Wildlife		
Other		

- Section V – Narrative (who, what, when, where, how, why) – USE BACK SIDE OF THIS FORM!
- Attachments

Photographs Map Other Agency Report Other (specify)
Sketch Impound Inventory Witness Statement

別添資料 4

森林参照レベル（FRL）（2017 年 5 月時点のもの）

Initial Forest Reference Level for Cambodia under the UNFCCC Framework

May 22, 2017

Table of Content

Annex

Figure

Table

Reference Data

ABBREVIATIONS

ACRONYM	FULL WORD
AGB	Aboveground Biomass
BGB	Belowground Biomass
EF	Emission Factor
ELCs	Economic Land Concessions
FA	Forestry Administration
FAO	Food and Agriculture Organization of the United Nations
FiA	Fisheries Administration
FREL	Forest Reference Emission levels
FRL	Forest Reference Level
GDANCP	General Department of Administration for Nature Conservation and Protection
INDC	Intended Nationally Determined Contribution
IPCC	Intergovernmental Panel on Climate Change
LULUCF	Land Use, Land Use Change and Forestry
MAFF	Ministry of Agriculture Forestry and Fisheries
MMU	Minimum Mapping Unit
MoE	Ministry of Environment
NFI	National Forest Inventory
NFMS	National Forest Monitoring System
NPASMP	National Protected Areas Strategic Management Plan
NRS	National REDD+ Strategy
NSDP	National Strategic Development Plan
ODA	Official Development Assistance
PA	Protected Area
PFE	Permanent Forest Estate
PFR	Permanent Forest Reserve
PSP	Permanent Sample Plots
REDD	Reducing Emission from Deforestation and Forest Degradation
RGC	Royal Government of Cambodia
SIS	Safeguard Information System
SLCs	Social Land Concessions
SOM	Soil Organic Matter

1. Introduction

1.1. FRL submission

In accordance with decisions 4/CP.15, 1/CP.16, 12/CP.17, 13/CP.19, Cambodia is submitting on a voluntary basis for consideration by the UNFCCC its initial Forest Reference Level (FRL).

In this report, we provide an overview of the data and methodologies used to develop Cambodia's initial FRL. The information presented is intended to be transparent, complete, consistent, and accurate, and is guided by the most recent IPCC guidance and guidelines (IPCC, 2003a, 2003b, 2006a, 2006b). The submission of a FRL is exclusively for the purpose of obtaining and receiving payments for results from Cambodia's REDD+ program implementation.

Cambodia has high levels of deforestation and forest degradation but limited capacity and finance and expects to face continuing challenges to reduce emissions. The Cambodia REDD+ strategy outlines the policies and measures intended to reduce emission from deforestation and forest degradation. As these policies and measures are shaped they are expected to introduce long-term effects.

1.2. Cambodia's forest sector

Cambodia covers a total area of 181,035 km2. Cambodia is categorized as a least developed, low-income country. Relative peace and stability over the past decade has brought steady economic growth, averaging between 7 and 10 percent since 1998, leading to substantial reductions in poverty, but also increased pressure on Cambodia's natural resources. Cambodia was able to maintain a relatively high forest cover, with one of the highest levels of forest cover in Southeast Asia. While the current forest cover is still relatively high, Cambodia lost a considerable amount of forest over the last two decades, and the pace of land use and forest conversion has seen acceleration.

Cambodia's forest area is governed by three institutions: Forestry Administration (FA) of the Ministry of Agriculture, Forestry and Fisheries, Fisheries Administration (FiA) of the Ministry of Agriculture, Forestry and Fisheries (MAFF), General Department of Administration for Nature Conservation and Protection (GDANCP) of the Ministry of Environment (MoE).

FA is the government authority under MAFF, in managing forest and forest resources of the Permanent Forest Estate (PFE), which comprises naturally growing and planted state forest resources, and is subdivided into the Permanent Forest Reserve (PFR) and Private Forest. The PFR is composed of Production Forest, Protection Forest, and Conversion Forestland. Private

Forests shall be maintained by owners with interesting right to manage, develop and harvest, use, sell, and distribute the product by themselves (Source: Forestry Law 2002).

The policy objectives of the forestry sector under Permanent Forest Estate (PFE) are synthesized into an overarching strategic framework set out in the National Forest Programme 2010-2029, which defines the policy and implementation strategies for the sustainable management of the nation's forestry sector under a series of programmes, including (a) forest demarcation, classification and registration; (b) Conservation and Development of Forest Resource and biodiversity; (c) forest law enforcement and governance; (d) community forestry programme; (e) capacity and research development; and (f) sustainable forest financing.

Forest resources within Protected Areas (PA) are under the jurisdictional management and regulatory authority of the General Department of Administration for Nature Conservation and Protection (GDANCP) of the Ministry of Environment (MoE) under the 2008 Protected Areas Law. Cambodia's 23 PAs covering about 3.2 million ha, or 18% of total land area. The National Protected Areas Strategic Management Plan (NPASMP) 2016-2030 outlines the implementation framework for achieving its vision of effective, efficient and equitable management of the national protected area system in Cambodia.

Under the 2006 Fisheries Law, inundated forests and mangrove areas outside of PAs are managed and regulated by the Fisheries Administration (FiA),[1] set out in the Strategic Planning Framework for Fisheries 2010-2019.

More general government policies related to climate change adaptation and mitigation include the National Climate Change Strategic Plan 2014-2023, National Strategic Plan on Green Growth Development 2013-2030, and the White Paper on Land Policy, enacted in 2015, which seeks to harmonize cross-sectoral land-use policy to ensure sustainability. In addition, a law on Environmental Impact Assessment and an Environmental Code are being developed. The National Council for Sustainable Development was recently formed to spearhead the harmonization of Cambodia's sustainable development efforts. These various efforts by RGC are expected to support to mitigate emissions from the forestry sector by improving governance, inter-ministerial coordination and coherence of land use policy.

Specifically for REDD+ a number of institutions and mechanisms have been established to streamline REDD+ in government policy and pave the way for implementation of activities. The REDD+ Taskforce and Taskforce Secretariat have been established. A number of Technical Teams have been created to oversee day-to-day operations, and key components, including the NRS, SIS, and NFMS are being developed. Participation by all major stakeholders, including

local communities, indigenous groups, donors and civil society groups has been ensured.

2. Application of UNFCCC Modalities

2.1. UNFCCC modalities

The presented Initial Forest Reference Level (FRL) is consistent with the following UNFCCC decisions, among others:

1. Decision 4/CP.15: recognizing that developing country Parties in establishing forest reference emission levels and forest reference levels 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,
2. Decision 1/CP.16, paragraph 71: include forest reference emission levels as one of the four key elements to be developed for REDD+ in accordance with national circumstances and respective capabilities[1]
3. Decision 12/CP.17: modalities relating to forest reference emission levels and forest:
    - expressed in tonnes of carbon dioxide equivalent per year and serve as benchmarks for assessing the country's performance in implementing the activities referred to in decision 1/CP.16, paragraph 70
    - maintaining consistency with anthropogenic forest-related greenhouse gas emissions by sources and removals by sinks as contained in the country's greenhouse gas inventories
    - a step-wise approach to national forest reference emission level and/or forest reference level development, enabling Parties to improve the forest reference emission level and/or forest reference level by incorporating better data, improved methodologies and, where appropriate, additional pools
    - allowing updates periodically as appropriate, taking into account new knowledge, new trends and any modification of scope and methodologies
4. Decision 13/CP.19: Guidelines and procedures for the technical assessment of submissions from Parties on proposed forest reference emission levels FREL/FRL:
    - submission shall be subject to a technical assessment

[1] According to Decision 12/CP.17, countries can submit rational on the development of FRL including details of national circumstances and if adjusted include details on How the national circumstances were considered, in accordance with the guidelines.

- developing countries may, on a voluntary basis and when deemed appropriate, submit a proposed forest reference emission level and/or forest reference level
- proposed forest reference emission levels and/or forest reference levels might be technically assessed in the context of results-based payments

2.2 Consistency with National GHG reporting

Cambodia's initial FRL uses the most recent Intergovernmental Panel on Climate Change guidance and guidelines (IPCC 2003 GPG and 2006 guidelines) to estimate emissions. The period covered does not overlap with the earlier GHG inventories. Planned GHG inventories are set to use IPCC GPG 2003/2006 guidelines consistent with the FRL and the updated data used for the development of the FRL, reflecting improvements in methodologies and capacities to assess activity data, emission factors and emission/removal estimates.

3. Proposed Forest Reference Level

The Initial Forest Reference Level is assessed at 78,953,951 tCO2/year in Cambodia based on the historical average net emission levels from 2006 to 2014.

The average (AVG) net total annual CO2 emissions and removals (tCO2/year) are calculated following this equation;

$$\text{Average} = \frac{C_{def_{y1}} + C_{def_{y2}}}{n_{y1+y2}}$$

Where:

$\boldsymbol{C_{defy}}$: The sum of emissions from deforestation over the "y" years of emissions over the time of observation. In case of removal, the sum of removal over the "y" years of removal over the time of observation.

Table 3-1: Total Annual CO2 Emissions and Removals (t CO2 / year) FRL reference period

Period (year to year)	2006-2010	2010-2014
Annual CO_2 Removals (t CO_2 / year)	-7,109,077	-20,138,797
Annual CO_2 Emissions (t CO_2 / year)	34,111,931	151,043,845
Net Total Annual CO_2 Emissions and Removals (t CO_2 / year)	27,002,854	130,905,048
AVG Net Total Annual CO_2 Emissions and Removals (t CO_2 / year)	78,953,951	

Notice:

Cambodia defined Tree Plantation and Pine Plantation as forest. For the FRL, consistent with Safeguards, Cambodia excludes Emissions and Removals related to the two classes, in the case of conversion of natural forest classes, from the calculation of total Emissions and Removals.

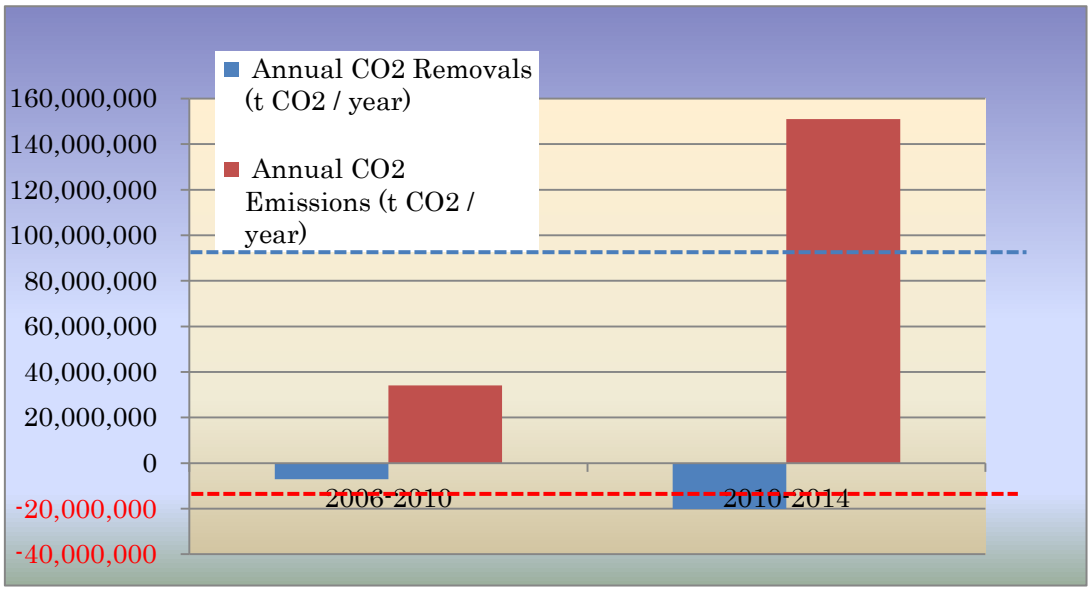


Figure 3-1: Histrical Trend of Annual CO_2 Emissions / Removals

Red dotted line is the Average annual CO_2 removal

Blue dotted line is the Average annual CO_2 emission

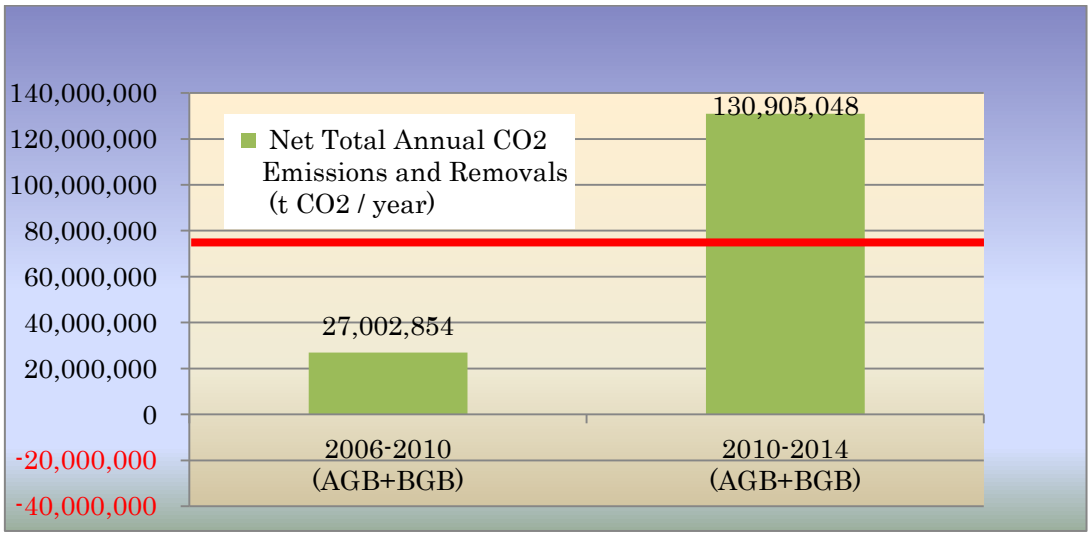


Figure 3-2: Historical Trend of Net Total Annual CO_2 Emissions

4. Information used for development of forest reference level

4.1. Scale

The FRL area encompasses Cambodia's Nation. The national scale is chosen to include considerations such as inter-institutional collaborations, with the responsibility of the forest estate under three institutions and linkages to national policies to implement REDD+. The national scale was possible due to the establishment of the National Forest Monitoring System (NFMS), availability of data and capacities.

It is however noted that REDD+ implementation could focus on specific areas before reaching the maturity of implementation at the national scale.

4.2. Scope

4.2.1. Scope of activity

Deforestation (forest land converted to other land types), degradation and enhancements (forest land remaining forest land with changes in forest sub-categories), and removal of CO_2 from the atmosphere through afforestation (other land uses converted to forest land) are included in the initial FRL.

Degradation and enhancement (through biomass stock changes within forest land without changes in forest sub-categories) are believed to be a significant contribution to emission or removals, however the information to monitor these type of degradation and enhancement (though biomass stock changes within forest land without changes in forest sub-categories) is for the moment not robust and reliable enough to be included in this FRL submission.

4.2.2. Scope of pools

Out of five carbon pools as described per IPCC guidelines, two pools, above ground biomass and below ground biomass, are included for the initial FRL establishment in Cambodia, which is consistent with LULUCF section in the national GHG inventory, and believed to be conservative while limited information exist on the litter, deadwood, and SOM pools. Information of these pools is expected after implementation of Cambodia's first National Forest Inventory (NFI).

Table 4-1: Carbon pools included in Initial FRL

Carbon Pool	Included/Excluded	Justification/ Explanation of Choice
Above Ground Biomass	Included	Major carbon pool affected by selected activity
Below Ground Biomass	Included	Major carbon pool affected by selected activity
Litter	Excluded	Stock change expected to be minor by selected activity and no data available.
Deadwood	Excluded	Stock change expected to be minor by selected activity and no data available.
Soil Organic Matter	Excluded	Stock change expected to be minor by selected activity and no data available.

4.2.3. Scope of Gas

Only CO_2 is included because in Cambodia emissions of other gases from land use and land use change are considered to be minor, and considered conservative while limited information exist on other gases. The Global Forest Resources Assessment (FAO, 2015) has recently released tables on forest fires; these figures are not used in the initial FRL to be conservative. Cambodia intends to monitor and explore inclusion of other gasses in its future submissions.

4.3. Definition of forest and land use classes

The forest definition adopted by Cambodia for REDD+ follows the National Forest Programme definition for forest and is consistent with the FAO FRA definition, but differs in the fact that rubber plantations Oil Palm plantations and Perennial crops are not reported as forests. In order to implement the Cambodia REDD+ programme, forests have been re-defined as follows:

Forest under the REDD+ programme refers to a unit of an ecosystem in the form of wetland and dry land covered by natural or planted vegetation with a height from 5 metres on an area of at least 0.5 hectares, and canopy crown cover of more than 10%.

Areas also included in the REDD+ programme are forest regrowth and areas under afforestation or reforestation (1). Rubber, oil palm plantations and perennial crops are excluded from this definition (2).

Notices:

(1). Afforestation or reforestation is an area of natural degraded forest land, forest fire, under natural forest regrowth/local planted trees where regenerated tree are expect to reach more than 50 percent of growing stock at stand maturity.

(2). Rubber plantation and oil palm plantation land are considered as crop land. Future removals from trees within crops land remaining crop land are not covered by FRL or result base payments for REDD+.

The forest definition adopted by Cambodia for REDD+ has been formed taking into consideration Decision 1/CP.16 Appendix 1E (safeguard natural forest), for countries seeking result based payments, the conversion of natural forest to plantations is not eligible for result based payments.

The following Table highlights the hierarchical structure of IPCC land use categories and National Land use/cover classes adapted for REDD+ purpose in Cambodia. Detailed description of the national land use/cover classes is provided in annex 2.

Table 4-2: land use types hierarchy:

No	Forest/Non-Forest	IPCC land use Category	No	National Land Use/Cover Categories	FRL Classes (Initial FRL)
1	Forest	Forest	1	Evergreen forest	Evergreen forest
			2	Semi-evergreen forest	Semi-evergreen forest
			3	Deciduous forest	Deciduous forest
			4	Pine forest	Pine forest
			5	Pine plantation	Pine plantation
			6	Tree plantation	Tree plantation
			7	Mangrove forest	Mangrove
			8	Rear mangrove	Rear mangrove
			9	Forest regrowth	Forest regrowth
			10	Flooded forest	Flooded forest
			11	Bamboo	Bamboo
2	Non-Forest	Crop land	12	Rubber plantation	Non-forest
			13	Oil palm	

			14	Paddy field	
			15	Crop Land	
3		Grassland	16	Grassland	
			17	Wood shrub	
4		Wetlands	18	Water	
5		Settlements	19	Built-up area	
			20	Village	
6		Other	21	Rock	
			22	Sand	

4.4. Historical period

The UNFCCC requires historical data to be taken into account for the construction of a FRL but does not specify the length of reference periods. In Cambodia, there is a continuing trend of rapid deforestation in recent years. Therefore the emissions from a recent period are expected to better reflect future emissions from deforestation in absence of REDD+. For this moment reliable and consistent historical activity data is only available from 2006 to 2014. Cambodia chose the years from 2006 to 2014 as historical period for initial FRL construction because of data availability and because Cambodia believes the recent data form a better approximation of deforestation rates in the near future in the absence of REDD+ implementation.

The choice of the reference period and use of historical average is based on a review of national circumstances. The average of historical emissions from the data available is conservative choice for approaching FRL construction, as explained in Section 4.5. However, there is a high degree of uncertainty regarding the impact of current circumstances in socioeconomic development, including policies and growth patterns, on the level of future emissions arising from forestland conversion.

4.5. National circumstances during historical period under review for FRL development

As part of the development of the FRL the national circumstances have been thoroughly reviewed. This section begins by describing an outline of the development of the legal and policy context for environmental conservation between 2006 and 2014. A qualitative analysis of the drivers of deforestation and forest degradation is then presented, as is an overview of the expected implications of Cambodia's for future emissions based on consideration of the national circumstances.

4.5.1. Legend and policy context during the reference period

The 2001 Land Law, 2002 Forestry Law, 2006 Law on Fisheries and the 2008 Protected Areas Law established the legal framework governing forest use in Cambodia. A series of sub-decrees elaborated on forestland management prescriptions, including a 2003 Sub-Decree (SD) on Community Forestry Management, 2003 SD on Social Land Concessions (SLCs), 2005 SD on Economic Land concessions (ELCs), and 2009 SD on Registration of Land of Indigenous Communities.

The National Strategic Development Plan (NSDP) contains the overarching goals and action plans for harmonizing and maximizing effectiveness of development efforts. It seeks to implement RGC's "Rectangular Strategy", focusing on growth, employment, equity and efficiency. Starting in 2006, the NSDP has emphasized natural resource management throughout its existence. Currently in its third phase, NSDP 2014-2018 aims to balance the demands for economic development and needs for conservation via a series of land and forestry reforms. Forest management is strengthened through the National Forest Programme (NFP) 2010-2029 for improved management forests in the PFR, while the National Strategic Plan on Green Growth and Development 2013-2030 seeks to develop regulatory frameworks and mechanisms for carbon trading and strengthening the capability, preparation and implementation of climate change adaptation measures, among other things. The NFP 2010-2029 defines the policy and implementation strategies for the sustainable management of the nation's forestry sector under a series of programmes, including forest demarcation, classification and registration; Conservation and development of forest resource and biodiversity; forest law enforcement and governance; community forestry programme; capacity and research development; and sustainable forest financing.

4.5.2. Drivers of forest cover change

The drivers of deforestation and forest degradation in Cambodia are the result of a complex set of interrelated factors related to a pattern of economic development and resulting land-use change in a context where state institutions still have limited capacity to enforce the existing regulatory frameworks, exacerbated by incomplete land management systems and lack of inter-ministerial coordination (Broadhead & Izquierdo, 2010). The REDD+ Roadmap identified a series of direct drivers, including clearance for agriculture, settlement expansion, infrastructure development, illegal logging, and unsustainable harvesting wood fuel, alongside a large set of indirect factors related to the socioeconomic environment and governance conditions both within and outside the forestry sector (Forestry Administration, 2010). Since then, a number of reports have sought to quantify these drivers, and have pointed to the relevance of SLCs, mining, large-scale infrastructure development, and unsustainable fuelwood collection and charcoal production, and an incomplete and often overlapping land management system (see Aruna Technology ltd, 2015; Delux & Van Rijn, 2015; GERES, 2015). Lack of up to date and reliable primary data is a common concern across all studies, limiting the ability to accurately assess the identified drivers. While rates of deforestation can relatively accurately be measured using Remote Sensing (RS) attributing observations support to specific agents and underlying causes requires information that is often absent. Nonetheless, findings from the

various studies indicate that the dominant driver of deforestation has been the conversion of forestland to large-scale agro-industrial plantations by private investors under Economic Land Concessions (ELCs) (Banks, Sloth, Garcia, & Ra, 2014; Forests Trends, 2015; Lawson et al., 2014). The dramatic increase in emissions resulting from deforestation since 2010 is likely a consequence of an increase in forestland conversion and timber harvesting within sites allocated for ELCs and agricultural expansion for cash crops. Forest disturbance resulting from the expansion of monoculture plantations for rubber has been statistically linked to international market price fluctuations, with the past few years seeing higher market prices , and exceptionally high disturbance rates (Grogan, Pflugmacher, Hostert, Kennedy, & Fensholt, 2015).

Both MoE and MAFF have the authority to issue ELCs.[2] [Between 1996 and 2012, MAFF and MoE allocated ELCs covering 1,55 mill. ha (Source: MAFF on 21 Jul 2016) and 470,000 ha of Cambodia's approximately (Source: MoE reported on 15 Sept 2015). The allocation of land to ELCs halted with the implementation of Directive01 in 2012, although some forests within existing ELCs are still largely intact, and conversion to inside these ELCs is expected to remain for the coming years.

SLCs are a legal mechanism for redistributing land to for socioeconomic development. There are two categories of beneficiaries of SLCs: (a) poor and landless families or families of former military personnel, (b) communities requiring land for local development projects such as physical infrastructure, for future population increase, and (c) issued land title to local people (RGC, directive01). Although the procedural requirements for the granting and distribution of SLCs have been in place since the 2003[3], the mechanism was not fully utilized until 2010. [Between 2009 and 2013, government land allocated for SLCs 2,450,000 ha (Source: MLMUPC declaration dated on 25 Jan, 2016)]. Due to an increasing scarcity of available land, combined with an incomplete forest demarcation, SLCs often encroach on forestland and have been linked to deforestation and forest degradation, although the aggregate impact is unknown. Nevertheless, monitoring of both ELCs and SLCs are being conducted by RGC to ensure alignment with laws and regulations. The National REDD+ strategy is envisioned to strengthen this monitoring.

Under Directive01, RGC has accelerated land titling through the sporadic and systematic land registration systems, in addition to implementing an "old policy, new action" initiative. A

[2] Under the 2008 Protected Area Law and 2001 Land Law, respectively

[3] 2003 Sub-decree on Social Land Concessions

total of around 1.2 mill.ha of land titles have been distributed so far. The land registration system and SLC programmes are embedded with incentives for land clearance. Claimants must prove occupation of land parcel for a minimum of five years, and SLC holders must abide by conditions that include development of the land through agricultural cultivation.

4.5.3. Future

A number of trends in the national context point to continued high emission levels arising from the land use and forestry sectors in the future. Strong economic growth is expected to continue, and is likely to continue relying on extractive economic institutions in the land-use sectors for the immediate future. Expansion of monoculture cropping is expected to grow as the Cambodian government invests in strengthening commercialization for small-scale farmers and enhancing linkages between large-scale agro-industrial plantations and surrounding smallholders. Examples of relevant policies include the policy on "Promotion of Paddy Rice Production and Milled Rice Export" and the "National Rubber Development Strategy 2011-2020."

Although the sector is currently underdeveloped, mining is expected to grow extensively in the future with increased foreign investment and improved technology, with uncertain implications for forests. An unknown area has been granted by MME for mining and mineral exploration. Moreover, Investment in the construction of hydropower dams to supply the population's growing energy needs is growing, with numerous projects at varying stages of development. These large-scale projects are regulated by the 2007 Concessions Law, without effective mechanisms for ensuring of environmental and social safeguards, there is a risk that logging and other illegitimate extractive practices will occur.

Many of the issues illustrated above illustrate the need for a well-functioning and effective governance of the forestry sectors and coherent approach to policies within the land-use sectors. Today, government reforms to align development priorities with conservation efforts and inculcate coherence in land use are well underway. RGC's submission of its Intended Nationally Determined Contribution (INDC) in 2015 outlines Cambodia's efforts at reducing greenhouse gas emissions by sector. There is thus a growing recognition of the need for enhanced efforts at climate change mitigation and adaptation.

As Cambodia graduates to Lower-Middle Income Country status in the near future (RGC, 2014), donor funding will dissipate and RGC will have to seek funding from other sources.

Already by 2013, a larger share of Overseas Development Assistance took the form of concessional loans compared to ODA grants (CDC, 2014). In 2012, of a total of USD 1.50 billion around USD 14 million and USD 7 million of a total of 1.5 billion USD for ODA were committed to environment and conservation, and climate change, respectively.

Cambodia will continue to integrate into regional and global markets, with uncertain implications for environmental conservation. As the ASEAN Economic Community is consolidated, Cambodia's forests could become increasingly threatened as economic hubs become increasingly connected. On the other hand, further integration might be accompanied by pressures for strengthened state regulations of the flow of goods across borders.

For these reasons and acknowledging the uncertainty of future impacts on emissions within these sectors, averaging historical emissions over 2006-2014 represents a conservative approach to FRL development.

4.6. Approach for FRL establishment

Cambodia takes an approach based on historical average of net emission from deforestation[4] for eight years from 2006 to 2014. The reason for the choice of this methodology is due to the national circumstances outlined above and the fact that there are only three points in time for activity data. Three data points (for two change assessments) are considered insufficient to create a regression line for the predication of future trends.

4.7. Methodology

Historical emission estimates are developed based on the activity data from 2006 to 2014. Annual CO^2 Emissions and Removals (tCO_2 / year) are calculated by the following equation;

$$\Delta C_B = \frac{(Ct_2 - Ct_1)}{(t_2 - t_1)}$$

$$\Delta CO_2 = \Delta C_B \times 44/12$$

ΔC_B = annual change in carbon stocks in biomass (the sum of above-ground and below-ground biomass) in land remaining in the same category (e.g., Forest Land Remaining Forest Land), tonnes C yr-1
C t_2 = total carbon in biomass for each land sub-category at time t_2, tonnes C
C t_1 = total carbon in biomass for each land sub-category at time t_1, tonnes C
Ct (Total Emission) = Activity Data (A) × Emission Factor (EF)
44/12: Molecular weight ratio of carbon dioxide to carbon
(IPCC, 2006b)

4.8. Activity Data

Activity data explains the extent of human activities, in this case expressed in land use and land use change maps. There are several historical forest cover maps in Cambodia; made in 1989, 1993, 1997, 2002, 2006, 2010 and 2014. However, there are inconsistencies in the definition of forests and the forest classification before the 2006 data. Therefore, Cambodia development of FRL, only the maps in 2006, 2010 and 2014 were used.

"Forest" and "Non Forest" classes were stratified according to newly defined land use/cover classes by using the same LANDSAT images used in the original mapping. Land use/cover class of each segment (polygon) was identified by visual interpretation of LANDSAT images. Information such as maps made by FAO and Mekong River Commission and images of

[4] Net emissions from deforestation in this context includes degradation and enhancements in areas of forest land remaining forest land but with changes in forest sub-categories, and removal of CO2 from the atmosphere through afforestation where other land uses are converted to forest land

Google Earth were also used as reference. The minimum mapping unit (MMU) of the Land use/cover classes was 5ha.

For consistency of the mapping procedure, LANDSAT 8 images were used to develop 2014 map. The segmentation technique was used in automatic polygon generation and then land use/cover class of each segment (polygon) was identified by visual interpretation of LANDSAT images. Google Earth images were also used as a reference.

Note: The detailed methodology to develop the activity data is described in Annex 3.

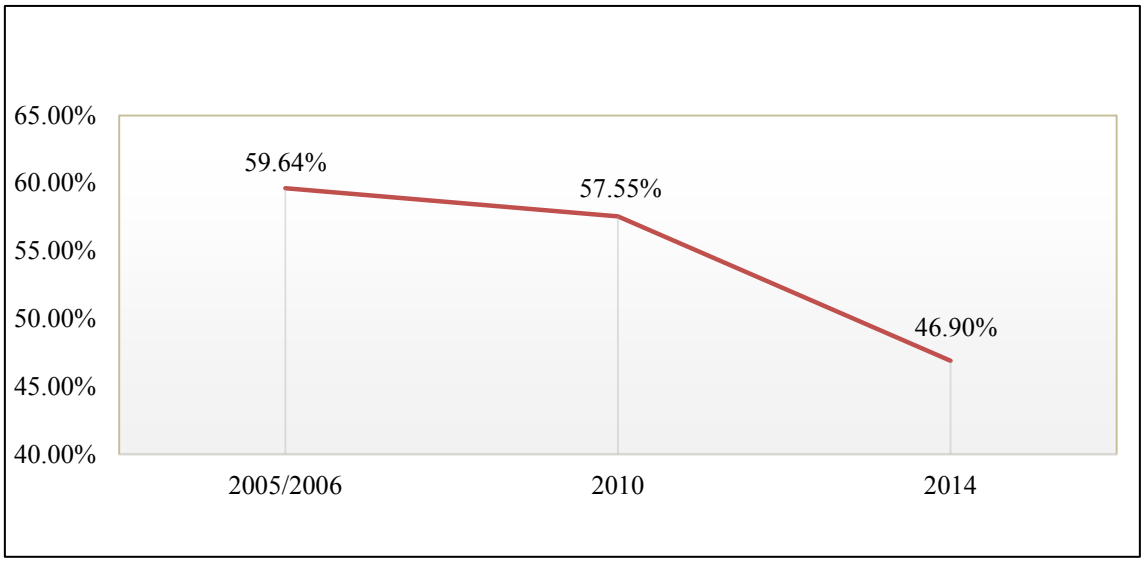


Figure 4-1: Change of forest cover from 2006 to 2014 excluding rubber and oil palm plantation as in the definition for REDD+

Table 4-3: Forest Cover and land use statistics in 2006, 2010 and 2014

Classification	2006		2010		2014	
	Ha	%	Ha	%	Ha	%
Evergreen forest	3,710,271	20.43%	3,573,925	19.68%	2,973,903	16.38%
Semi-evergreen forest	1,453,441	8.00%	1,391,117	7.66%	1,108,320	6.10%
Deciduous forest	4,613,417	25.40%	4,498,397	24.77%	3,480,532	19.17%
Flooded forest	597,355	3.29%	524,005	2.89%	481,078	2.65%
Forest regrowth	216,123	1.19%	249,341	1.37%	228,560	1.26%
Bamboo	129,837	0.71%	130,930	0.72%	130,678	0.72%
Mangrove	32,060	0.18%	31,443	0.17%	33,002	0.18%
Rear mangrove	27,519	0.15%	27,371	0.15%	25,906	0.14%
Pine forest	8,157	0.04%	8,157	0.04%	8,196	0.05%
Pine plantation	0	0.00%	11	0.00%	3,709	0.02%
Tree plantation	43,547	0.24%	17,214	0.09%	44,289	0.24%
Forest Area	**10,837,260**	**59.64%**	**10,451,911**	**57.55%**	**8,518,173**	**46.90%**
Oil palm plantation	35	0.00%	5,055	0.03%	36,311	0.20%
Rubber plantation	78,148	0.43%	137,307	0.76%	484,316	2.67%
Grassland	600,006	3.30%	473,281	2.61%	351,337	1.93%
Agriculture	1,000,634	5.51%	1,275,444	7.02%	2,787,413	15.35%
Paddy filed	3,668,981	20.20%	3,859,452	21.25%	4,133,474	22.76%
Rock	219	0.00%	668	0.00%	2,054	0.01%
Sand	8,304	0.05%	10,459	0.06%	40,581	0.22%
Built up area	37,435	0.21%	43,800	0.24%	328,820	1.81%
Village	248,126	1.37%	296,513	1.63%	42,166	0.23%
Water	438,410	2.41%	458,658	2.53%	813,839	4.48%
Wood shrub	1,248,649	6.88%	1,148,126	6.32%	622,190	3.43%
Non Forest	**7,328,947**	**40.36%**	**7,708,763**	**42.45%**	**9,642,501**	**53.10%**
Total Area	**18,160,674**	**100.00%**	**18,160,674**	**100.00%**	**18,160,674**	**100.00%**

4.9. Emission Factor

Emission factors (EF) are defined as CO2 emission per unit area induced by human activities. Emissions are estimated by calculating the change of carbon stock per unit area between two points in time. In FRL calculation, post-deforestation carbon stock is assumed to be zero. Emission factors for Aboveground Biomass (AGB) changes between forest types and changes between land use types are derived from the table below. Whereas Belowground Biomass (BGB) is estimated following application of a ratio recommended for tropical forests (IPCC 2003b).

Cambodia has never conducted a National Forest Inventory (NFI). Cambodia has recently designed a NFI. When implemented, the NFI is expected to improve the national emission factors. The post-deforestation carbon stock per unit of area is assumed zero because there is no reliable data on the replacing land-use and regrowth at the moment.

Based on existing references, Cambodia selected following AGB for FRL establishment. Detailed methodology is described in Annex 4.

Table 4-4: Estimation of above ground biomass (ton ha-1) by forest types in Cambodia

Forest type	AGB ton ha-1	C ton ha-1*	CO^2 ton ha-1**
Evergreen forest	163	76.6	280.90
Semi-evergreen	243	114.21	418.77
Deciduous	85	39.95	146.48
Forest regrowth	75	35.25	129.25
Flooded	70	32.90	120.6
Tree plantation	100	47.00	172.33
Pine plantation	100	47.00	172.33
Mangrove	150	70.50	258.50
Rear mangrove	165	77.55	284.35
Bamboo***	0	0.0	0

*0.47 was used as Carbon fraction (ton C /ton d.m.) from the default value in IPCC (2006b).

**One carbon equals 44/12 carbon dioxide.

References: CCEAP (2003), CFI (2008), IPCC (2006b), JICA TAT (2015), Sasaki *et.al*. (2013), Sola *et al*. (2014), Tran (2015)

***Bamboo=0, mean that area land cover represented bamboo class are very small

Above ground biomass values for Evergreen, Semi-evergreen and Deciduous forests were

estimated based on the estimation by Sola *et al*. (2014). Chave *et al*. (2005) equations were used for the calculation.

-Dry zone (Annual rain < 1500 mm):

$AGB=WD\times(-2.187+0.916\times\ln(WD\times DBH^2\times H)$

- Moist zone (1500 mm ≤ Annual rain ≤ 3500 mm):

$AGB=WD\times(-(DB0$ mm):$\times DBH^2\times H)$

- Wet zone (Annual rain > 3500 mm):

$AGB=WD\times(-2.557+0.940\times\ln(WD\times DBH^2\times H)$

Where

AGB: Above ground biomass of trees

DBH: Diameter at breast height

WD: Wood density

H: Tree height

- Tree height was estimated with the local H-DBH model for trees (Sola *et al*., 2014)

$$H=1.3+9.303525\times DBH^{0.24991}$$

-BGB was calculated from AGB using the following equation.

UBGB (ton/ha of dry matter) = exp[-1.0587 + 0.8836 • ln (UAGB)]

Variable: UAGB (Unit Above Ground biomass) (ton / ha of dry matter)

Application: tropical forests

(Reference: IPCC (2003b))

5. Transparency, completeness, consistency and uncertainty of information

Per decision 12/CP17 Guidelines for submissions of information on reference levels, information provided in the FRL submission should include information that is Transparent, Complete, Consistent and Accurate, for the purpose of allowing a technical assessment of the data. The following information supports this.

5.1. Transparency

Decision 12/CP.17 requires transparent and consistent information should be provided, that is, information should be accessible by all relevant stakeholders and updated on a regular basis. The data used for calculation of emission factors of the FRL will be published after completion of the technical assessment. Also, the results of FRL are accessible by all relevant stakeholders through developed web interface which will be updated when FRL is updated. This report will also be open for public access. Key information is publically accessible on *www.cambodia-redd.org.*

5.2. Completeness

Completeness in Decision 12/CP.17 means whether the provision of information allows for the reconstruction of the FRL. Methods used are clearly described in the previous section and in the annexes. Therefore, the FRL can be reconstructed. The data provided in the FRL is complete to the extent possible and intentions to improvements are outlined in the separate section and in chapter 7 Plan for FRL improvement. Raw data for emission factors and activity data are available upon request from the REDD+ secretariat, Cambodia.

5.3. Consistency

Decision 12/CP.17 requires that the forest reference levels shall maintain consistency with anthropogenic forest related greenhouse gas emissions by sources and removals by sinks as contained in the country's national greenhouse gas inventory (GHG inventory). As described in chapter 1.2 Cambodia's initial FRL development reflecting improvements in methodologies and capacities to assess activity data, emission factors and emission/removal estimates. The FRL historical period covered does not overlap with the earlier GHG inventories, future planned GHG inventories are set to be consistent with the improvements reflected in the FRL.

5.4. Accuracy

5.4.1. Accuracy of Emission factors

In Cambodia, no nationwide forest inventory has been conducted. Although localities were limited, 39 PSP and above 474 REDD+ related project and 528 community forest survey data were collected for calculation of emission factors for main forest types, Evergreen,

Semi-evergreen and Deciduous forest. Coefficient of variation (CV) for those forest inventory data ranges from 0.99 % to 1.47%. These relatively high values of CV are expected to decrease by conducting the National Forest Inventory (NFI) in the future. For other forest types, emission factors will also be improved through the NFI.

5.4.2. Accuracy of Activity Data

Accuracy assessment of the original 2006 and 2010 forest assessment map was performed by Geographic Resource Analysis & Science A/S (GRAS). The report was compiled as Accuracy Assessment Report (draft final). Overall accuracy of the five classes – Evergreen Forest, Semi-evergreen forest, Deciduous Forest, Other Forest and Non-Forest, was 74% of 2006 map and 85% of 2010 map.

New accuracy assessment of the upgraded 2006 map and 2010 map was performed after the completion of the initial classification edit. The accuracy assessment of 2014 map, total number of accuracy assessment points was calculated by using the same Congalton & Green formula and distributed for each class in proportion to the area of each class. Overall accuracy of the 22 classes was 81.23% with kappa 79.49% (Annex 3).

Furthermore, Cambodia is currently undertaking an accuracy assessment of change of land use change data between 2006 and 2010, and between 2010 and 2014. The results are expected to be made available to the technical assessment team and part of future FRL submissions once available.

6. Plan of FRL improvement

The FRL submission presented in this report is thought to best reflect current methodologies, data and capacities to assess activity data, emission factors and emission/removal estimates, with an intention to improve future FRL submission.

The initial FRL is based on activity data between 2006 and 2014; it is envisioned that future FRL submissions include updates of the land use/cover data. It is planned to produce land use/cover map every two years from 2016.

Accuracy of data in the initial FRL based on activity assessment performed for individual maps it is envisioned that an assessment of the accuracy of land use changes will be performed in the future.

Improvements in both emission factors and activity data are expected through implementation of Cambodia's first NFI. The data in Sola *et al*. (2014) used assessing the AGB of Evergreen, Semi-evergreen and Deciduous forest are based on a collection of data from several locations, but do not represent a systematical assessment of forest in Cambodia.

An allometric equation is used to calculate dry weight, above ground biomass of a tree from easier-to-measure characteristics such as tree diameter or height. For the initial FRL development, general allometric equations were used. However, tree forms differ from one species to another, and therefore so would tree biomass and allometric equations. Country specific allometric equations will be developed to increase reliability

Recent studies show that wood density is an important predictor of tree biomass (Chave *et al*., 2014). Available methodologies and associated cost for measuring it in forest inventories are huge constraints but average wood density at tree species level can be used without creating bias (Fayolle *et al*., 2013). Therefore, developing a table of wood density values at species level would improve biomass estimates (Sola *et al*., 2014).

Overall consistency between FRL submissions and National GHG reporting is strengthened by the establishment of a REDD+ database. All information and subsequent updates in information are stored in the database, allowing for improvement of consistency between various submission reports.

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Annex 1 Emission/Removal Calculation Tables

Table 1: Forest Area Change Matrix between 2006 and 2010(ha)

Forest Type		Year 2010(Ha)												Total (Ha)	
		E	Se	P	D	B	M	Mr	Ff	Fr	Tp	Pp	NF		
Year 2006	E	3,560,063.5				20.2				4,610.3	1,055.9		144,521.1	3,710,271	20.4%
	Se	171.6	1,384,195.9		12.6					3,285.3	42.1		65,733.4	1,453,441	8.0%
	P			8,156.6									0.0	8,157	0.0%
	D				4,477,380.9	9.7		8.4		1,114.6	2,275.6		132,627.8	4,613,417	25.4%
	B					128,795.8				11.4			1,029.8	129,837	0.7%
	M	143.5	55.2				31,031.2	40.2					789.5	32,060	0.2%
	Mr		77.7				90.8	26,482.7		43.2			824.5	27,519	0.2%
	Ff								471,842.1	592.2			124,920.9	597,355	3.3%
	Fr	174.9	5.9		83.2			10.9	20.4	190,385.9	277.4		25,164.5	216,123	1.2%
	Tp		16.7		26.1				7.5	161.5	8,013.9		35,321.3	43,547	0.2%
	Pp												0.0	0	0.0%
	NF	13,371.6	6,765.9	0.0	20,894.0	2,104.8	320.7	828.5	52,135.3	49,137.1	5,549.2	10.9	7,177,829.2	7,328,947	40.4%
Total		3,573,925	1,391,117	8,157	4,498,397	130,931	31,443	27,371	524,005	249,342	17,214	11	7,708,762	18,160,674	100.0%
		19.7%	7.7%	0.0%	24.8%	0.7%	0.2%	0.2%	2.9%	1.4%	0.1%	0.0%	42.4%	100.0%	

Table 2: Forest Living Aboveground Biomass Carbon Stock of 2006

Forest Type		Year 2010												Total (t C)	
		E	Se	P	D	B	M	Mr	Ff	Fr	Tp	Pp	NF		
Year 2006	E	272,736,465	0	0	0	1,548	0	0	0	353,195	80,892	0	11,071,761	284,243,861	42.5%
	Se	19,598	158,089,014	0	1,439	0	0	0	0	375,214	4,808	0	7,507,412	165,997,485	24.8%
	P	0	0	383,360	0	0	0	0	0	0	0	0	0	383,360	0.1%
	D	0	0	0	178,871,367	388	0	336	0	44,528	90,910	0	5,298,481	184,306,009	27.6%
	B	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
	M	10,117	3,892	0	0	0	2,187,700	2,834	0	0	0	0	55,660	2,260,202	0.3%
	Mr	0	6,026	0	0	0	7,042	2,053,733	0	3,350	0	0	63,940	2,134,091	0.3%
	Ff	0	0	0	0	0	0	0	15,523,605	19,483	0	0	4,109,898	19,652,986	2.9%
	Fr	6,165	208	0	2,933	0	0	384	719	6,711,103	9,778	0	887,049	7,618,339	1.1%
	Tp	0	785	0	1,227	0	0	0	353	7,591	376,653	0	1,660,101	2,046,709	0.3%
	Pp	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
	NF	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
Total														668,643,043	100.0%

Density	
t AGB/ha	t C/ha
163	76.61
243	114.21
100	47.00
85	39.95
0	0.00
150	70.50
165	77.55
70	32.90
75	35.25
100	47.00
100	47.00
-	0.00
-	#REF!

AGB value is integar.

t AGB/ha= 0.47 t C/ha

Table 3:Forest Living Aboveground Biomass Carbon Stock of 2010

Forest Type		Year 2010												Total
		E	Se	P	D	B	M	Mr	Ff	Fr	Tp	Pp	NF	
Year 2006	E	272,736,465	0	0	0	0	0	0	0	162,513	49,627	0	0	
	Se	13,146	158,089,014	0	503	0	0	0	0	115,807	1,979	0	0	
	P	0	0	383,360	0	0	0	0	0	0	0	0	0	
	D	0	0	0	178,871,367	0	0	651	0	39,290	106,953	0	0	
	B	0	0	0	0	0	0	0	0	402	0	0	0	
	M	10,994	6,304	0	0	0	2,187,700	3,118	0	0	0	0	0	
	Mr	0	8,874	0	0	0	6,401	2,053,733	0	1,523	0	0	0	
	Ff	0	0	0	0	0	0	0	15,523,605	20,875	0	0	0	
	Fr	13,399	674	0	3,324	0	0	845	671	6,711,103	13,038	0	0	
	Tp	0	1,907	0	1,043	0	0	0	247	5,693	376,653	0	0	
	Pp	0	0	0	0	0	0	0	0	0	0	0	0	
	NF	1,024,398	772,733	0	834,715	0	22,609	64,250	1,715,251	1,732,083	260,812	512	0	
Total		273,798,402	158,879,507	383,360	179,710,952	0	2,216,710	2,122,598	17,239,774	8,789,288	809,063	512	0	643,950,166
		42.5%	24.7%	0.1%	27.9%	0.0%	0.3%	0.3%	2.7%	1.4%	0.1%	0.0%	0.0%	100.0%

Carbon Density t C/ha	76.61	114.21	47.00	39.95	0.00	70.50	77.55	32.90	35.25	47.00	47.00	0.00	35.46

Table 4: Forest Living Aboveground Biomass Carbon Stock Change Matrix between 2006 and 2010

Forest Type		Year 2010												Total (t C)	
		E	Se	P	D	B	M	Mr	Ff	Fr	Tp	Pp	NF		
Year 2006	E	0	0	0	0	1,548	0	0	0	190,682	31,265	0	11,071,761	11,295,256	45.7%
	Se	6,452	0	0	936	0	0	0	0	259,407	2,830	0	7,507,412	7,777,036	31.5%
	P	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
	D	0	0	0	0	388	0	-316	0	5,239	-16,043	0	5,298,481	5,287,748	21.4%
	B	0	0	0	0	0	0	0	0	-402	0	0	0	-402	0.0%
	M	-877	-2,413	0	0	0	0	-283	0	0	0	0	55,660	52,087	0.2%
	Mr	0	-2,848	0	0	0	640	0	0	1,827	0	0	63,940	63,559	0.3%
	Ff	0	0	0	0	0	0	0	0	-1,392	0	0	4,109,898	4,108,506	16.6%
	Fr	-7,234	-466	0	-391	0	0	-461	48	0	-3,259	0	887,049	875,285	3.5%
	Tp	0	-1,122	0	184	0	0	0	106	1,898	0	0	1,660,101	1,661,166	6.7%
	Pp	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
	NF	-1,024,398	-772,733	0	-834,715	0	-22,609	-64,250	-1,715,251	-1,732,083	-260,812	-512	0	-6,427,365	-26.0%
Total		-1,026,057	-779,583	0	-833,987	1,935	-21,969	-65,310	-1,715,098	-1,274,823	-246,020	-512	30,654,301	24,692,876	100.0%
		-4.2%	-3.2%	0.0%	-3.4%	0.0%	-0.1%	-0.3%	-6.9%	-5.2%	-1.0%	0.0%	124.1%	100.0%	

Table 5: Forest Living Aboveground Biomass CO2 Emission / Removal Matrix between 2006 and 2010

Forest Type		Year 2010												Total	
		E	Se	P	D	B	M	Mr	Ff	Fr	Tp	Pp	NF		
Year 2006	E	0	0	0	0	5,674	0	0	0	699,167	114,639	0	40,596,459	41,415,939	45.7%
	Se	23,658	0	0	3,431	0	0	0	0	951,160	10,375	0	27,527,176	28,515,800	31.5%
	P	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
	D	0	0	0	0	1,421	0	-1,158	0	19,208	-58,824	0	19,427,762	19,388,409	21.4%
	B	0	0	0	0	0	0	0	0	-1,473	0	0	0	-1,473	0.0%
	M	-3,215	-8,847	0	0	0	0	-1,039	0	0	0	0	204,086	190,985	0.2%
	Mr	0	-10,444	0	0	0	2,347	0	0	6,700	0	0	234,447	233,050	0.3%
	Ff	0	0	0	0	0	0	0	0	-5,103	0	0	15,069,625	15,064,522	16.6%
	Fr	-26,524	-1,708	0	-1,434	0	0	-1,691	176	0	-11,951	0	3,252,512	3,209,379	3.5%
	Tp	0	-4,115	0	675	0	0	0	388	6,958	0	0	6,087,037	6,090,942	6.7%
	Pp	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
	NF	-3,756,127	-2,833,356	0	-3,060,623	0	-82,901	-235,584	-6,289,255	-6,350,970	-956,312	-1,878	0	-23,567,006	-26.0%
Total		-3,762,208	-2,858,471	0	-3,057,951	7,095	-80,554	-239,472	-6,288,691	-4,674,352	-902,074	-1,878	112,399,103	90,540,546	100.0%
		-4.2%	-3.2%	0.0%	-3.4%	0.0%	-0.1%	-0.3%	-6.9%	-5.2%	-1.0%	0.0%	124.1%	100.0%	

CO_2 Emission for 4 years from 2006 to 2010 without emissions from forest conversion to forest plantation	114,120,066	t CO_2
CO_2 Removal for 4 years from 2006 to 2010 without emissions from forest conversion to forest plantation	-23,633,758	t CO_2
CO_2 Emission / Removal for 4 years from 2006 to 2010 without emissions from forest conversion to forest plantation	90,486,308	t CO_2
Annual CO_2 Emission from 2006 to 2010 without emissions from forest conversion to forest plantation	28,530,017	t CO_2/yr
Annual CO_2 Removal from 2006 to 2010 without emissions from forest conversion to forest plantation	-5,908,440	t CO_2/yr
Annual CO_2 Emission / Removal from 2006 to 2010 without emissions from forest conversion to forest plantation	22,621,577	t CO_2/yr

Table 6: Forest Living Belowground Biomass Carbon Stock of 2006

Forest Type		Year 2010												Total (t C)	
		E	Se	P	D	B	M	Mr	Ff	Fr	Tp	Pp	NF		
Year 2006	E	52,297,333	0	0	0	297	0	0	0	67,725	15,511	0	2,123,015	54,503,881	41.9%
	Se	3,586	28,929,694	0	263	0	0	0	0	68,663	880	0	1,373,828	30,376,915	23.4%
	P	0	0	77,814	0	0	0	0	0	0	0	0	0	77,814	0.1%
	D	0	0	0	36,983,166	80	0	69	0	9,207	18,796	0	1,095,506	38,106,824	29.3%
	B	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
	M	1,959	753	0	0	0	423,576	549	0	0	0	0	10,777	437,614	0.3%
	Mr	0	1,154	0	0	0	1,348	393,268	0	642	0	0	12,244	408,656	0.3%
	Ff	0	0	0	0	0	0	0	3,284,021	4,122	0	0	869,449	4,157,592	3.2%
	Fr	1,294	44	0	616	0	0	81	151	1,408,856	2,053	0	186,217	1,599,311	1.2%
	Tp	0	159	0	249	0	0	0	72	1,541	76,453	0	336,965	415,438	0.3%
	Pp	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
	NF	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
Total														130,084,045	100.0%

Density	
t BGB/ha	t C/ha
31.25	14.69
44.48	20.90
20.30	9.54
17.58	8.26
0.00	0.00
29.04	13.65
31.59	14.85
14.81	6.96
15.74	7.40
20.30	9.54
20.30	9.54
0.00	0.00
-	7.2

BGB is estimated from AGB based on Carins et al (1997) in IPCC (2003).

t BGB/ha= 0.47 t C/ha
C value is round off to two decimal places.

Table 7: Forest Living Belowground Biomass Carbon Stock of 2006

Forest Type		Year 2010												Total
		E	Se	P	D	B	M	Mr	Ff	Fr	Tp	Pp	NF	
Year 2006	E	52,297,333	0	0	0	0	0	0	0	34,116	10,073	0	0	
	Se	2,521	28,929,694	0	104	0	0	0	0	24,311	402	0	0	
	P	0	0	77,814	0	0	0	0	0	0	0	0	0	
	D	0	0	0	36,983,166	0	0	125	0	8,248	21,709	0	0	
	B	0	0	0	0	0	0	0	0	84	0	0	0	
	M	2,108	1,154	0	0	0	423,576	597	0	0	0	0	0	
	Mr	0	1,624	0	0	0	1,239	393,268	0	320	0	0	0	
	Ff	0	0	0	0	0	0	0	3,284,021	4,382	0	0	0	
	Fr	2,569	123	0	687	0	0	162	142	1,408,856	2,646	0	0	
	Tp	0	349	0	216	0	0	0	52	1,195	76,453	0	0	
	Pp	0	0	0	0	0	0	0	0	0	0	0	0	
	NF	196,429	141,407	0	172,584	0	4,378	12,303	362,862	363,615	52,939	104	0	
Total		52,500,960	29,074,352	77,814	37,156,758	0	429,193	406,455	3,647,077	1,845,127	164,223	104	0	125,302,061
		41.9%	23.2%	0.1%	29.7%	0.0%	0.3%	0.3%	2.9%	1.5%	0.1%	0.0%	0.0%	100.0%

Carbon Density t C/ha	14.69	20.90	9.54	8.26	0.00	13.65	14.85	6.96	7.40	9.54	9.54	0.00	6.90

Table 8: Forest Living Belowground Biomass Carbon Stock Change Matrix between 2006 and 2010

Forest Type		Year 2010												Total (t C)	
		E	Se	P	D	B	M	Mr	Ff	Fr	Tp	Pp	NF		
Year 2006	E	0	0	0	0	297	0	0	0	33,609	5,438	0	2,123,015	2,162,359	45.2%
	Se	1,066	0	0	159	0	0	0	0	44,352	478	0	1,373,828	1,419,883	29.7%
	P	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
	D	0	0	0	0	80	0	-55	0	959	-2,913	0	1,095,506	1,093,576	22.9%
	B	0	0	0	0	0	0	0	0	-84	0	0	0	-84	0.0%
	M	-149	-400	0	0	0	0	-48	0	0	0	0	10,777	10,179	0.2%
	Mr	0	-470	0	0	0	109	0	0	322	0	0	12,244	12,205	0.3%
	Ff	0	0	0	0	0	0	0	0	-261	0	0	869,449	869,189	18.2%
	Fr	-1,275	-80	0	-72	0	0	-81	9	0	-594	0	186,217	184,125	3.9%
	Tp	0	-190	0	33	0	0	0	19	346	0	0	336,965	337,174	7.1%
	Pp	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
	NF	-196,429	-141,407	0	-172,584	0	-4,378	-12,303	-362,862	-363,615	-52,939	-104	0	-1,306,621	-27.3%
Total		-196,787	-142,547	0	-172,463	377	-4,269	-12,488	-362,833	-284,373	-50,530	-104	6,008,001	4,781,984	100.0%
		-4.1%	-3.0%	0.0%	-3.6%	0.0%	-0.1%	-0.3%	-7.6%	-5.9%	-1.1%	0.0%	125.6%	100.0%	

Table 9: Forest Living Belowground Biomass CO2 Emission / Removal Matrix between 2006 and 2010

Forest Type		Year 2010												Total	
		E	Se	P	D	B	M	Mr	Ff	Fr	Tp	Pp	NF		
Year 2006	E	0	0	0	0	1,088	0	0	0	123,233	19,939	0	7,784,388	7,928,648	45.2%
	Se	3,907	0	0	584	0	0	0	0	162,622	1,754	0	5,037,370	5,206,237	29.7%
	P	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
	D	0	0	0	0	294	0	-203	0	3,515	-10,680	0	4,016,854	4,009,779	22.9%
	B	0	0	0	0	0	0	0	0	-309	0	0	0	-309	0.0%
	M	-547	-1,467	0	0	0	0	-177	0	0	0	0	39,514	37,323	0.2%
	Mr	0	-1,724	0	0	0	400	0	0	1,180	0	0	44,894	44,750	0.3%
	Ff	0	0	0	0	0	0	0	0	-955	0	0	3,187,981	3,187,026	18.2%
	Fr	-4,675	-292	0	-262	0	0	-298	33	0	-2,177	0	682,797	675,126	3.9%
	Tp	0	-696	0	122	0	0	0	71	1,267	0	0	1,235,539	1,236,304	7.1%
	Pp	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
	NF	-720,239	-518,493	0	-632,810	0	-16,051	-45,112	-1,330,493	-1,333,253	-194,111	-381	0	-4,790,943	-27.3%
Total		-721,554	-522,672	0	-632,366	1,382	-15,652	-45,789	-1,330,389	-1,042,700	-185,275	-381	22,029,337	17,533,941	100.0%
		-4.1%	-3.0%	0.0%	-3.6%	0.0%	-0.1%	-0.3%	-7.6%	-5.9%	-1.1%	0.0%	125.6%	100.0%	

CO_2 Emission for 4 years from 2006 to 2010 without emissions from forest conversion to forest plantation	22,327,654	t CO_2
CO_2 Removal for 4 years from 2006 to 2010 without emissions from forest conversion to forest plantation	-4,802,549	t CO_2
CO_2 Emission / Removal for 4 years from 2006 to 2010 without emissions from forest conversion to forest plantation	17,525,105	t CO_2
Annual CO_2 Emission from 2006 to 2010 without emissions from forest conversion to forest plantation	5,581,914	t CO_2/yr
Annual CO_2 Removal from 2006 to 2010 without emissions from forest conversion to forest plantation	-1,200,637	t CO_2/yr
Annual CO_2 Emission / Removal from 2006 to 2010 without emissions from forest conversion to forest plantation	4,381,276	t CO_2/yr

Table 10: Forest Living Aboveground Biomass CO2 Emission / Removal Matrix between 2010 and 2014

Emission and removal for 2010-2014 was calculated in the same manner with the 2006-2010 AGB and BGB emission/removal as shown above. Summary of emissions/removals for 2010-2014 are shown below

Forest Type		Year 2014												Total	
		E	Se	P	D	B	M	Mr	Ff	Fr	Tp	Pp	NF		
Year 2010	E	0	-11,567	0	81,916	0	468	-155	0	6,829,405	351,311	6,069	167,323,778	174,581,225	39.8%
	Se	0	0	0	0	34,507	0	0	0	4,710,461	395,408	22,598	122,854,346	128,017,319	29.2%
	P	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
	D	-2,782	0	0	0	981	0	0	0	208,821	-325,369	-1,610	166,838,174	166,718,215	38.0%
	B	0	0	0	0	0	0	0	0	-77,524	0	0	0	-77,524	0.0%
	M	0	0	0	0	0	0	-2,306	0	0	0	0	459,794	457,488	0.1%
	Mr	185	0	0	0	8,900	10,689	0	0	99,419	10,194	0	2,378,076	2,507,462	0.6%
	Ff	0	0	0	0	0	0	0	0	-15,403	0	0	14,119,492	14,104,089	3.2%
	Fr	-796,847	-951,565	0	-25,121	32,338	-3,852	-20,690	5,643	0	-91,936	-306	18,477,541	16,625,206	3.8%
	Tp	-1,205	-4,066	0	132	0	0	0	0	10,120	0	0	930,445	935,426	0.2%
	Pp	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
	NF	-11,063,462	-10,567,117	-6,842	-21,066,237	0	-765,936	-2,235,503	-9,077,719	-7,587,272	-2,255,654	-600,047	0	-65,225,788	-14.9%
Total		-11,864,112	-11,534,315	-6,842	-21,009,311	76,727	-759,630	-2,258,654	-9,072,076	4,178,027	-1,916,046	-572,296	493,381,646	438,643,118	100.0%
		-2.7%	-2.6%	0.0%	-4.8%	0.0%	-0.2%	-0.5%	-2.1%	1.0%	-0.4%	-0.1%	112.5%	100.0%	

CO_2 Emission for 4 years from 2006 to 2010 without emissions from forest conversion to forest plantation	505,415,632	t CO_2
CO_2 Removal for 4 years from 2006 to 2010 without emissions from forest conversion to forest plantation	-67,138,872	t CO_2
CO_2 Emission / Removal for 4 years from 2006 to 2010 without emissions from forest conversion to forest plantation	438,276,760	t CO_2
Annual CO_2 Emission from 2006 to 2010 without emissions from forest conversion to forest plantation	126,353,908	t CO_2/yr
Annual CO_2 Removal from 2006 to 2010 without emissions from forest conversion to forest plantation	-16,784,718	t CO_2/yr
Annual CO_2 Emission / Removal from 2006 to 2010 without emissions from forest conversion to forest plantation	109,569,190	t CO_2/yr

Table 11: Forest Living Belowground Biomass CO2 Emission / Removal Matrix between 2010 and 2014

Forest Type		Year 2014												Total	
		E	Se	P	D	B	M	Mr	Ff	Fr	Tp	Pp	NF		
Year 2010	E	0	-1,910	0	14,368	0	80	-26	0	1,203,732	61,103	1,056	32,084,405	33,362,806	39.1%
	Se	0	0	0	0	6,315	0	0	0	805,360	66,833	3,820	22,481,883	23,364,210	27.4%
	P	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
	D	-488	0	0	0	203	0	0	0	38,210	-59,074	-292	34,495,202	34,473,760	40.4%
	B	0	0	0	0	0	0	0	0	-16,275	0	0	0	-16,275	0.0%
	M	0	0	0	0	0	0	-392	0	0	0	0	89,024	88,631	0.1%
	Mr	31	0	0	0	1,704	1,819	0	0	17,510	1,772	0	455,376	478,213	0.6%
	Ff	0	0	0	0	0	0	0	0	-2,884	0	0	2,986,981	2,984,097	3.5%
	Fr	-140,450	-162,692	0	-4,597	6,789	-683	-3,644	1,057	0	-16,744	-56	3,878,973	3,557,953	4.2%
	Tp	-210	-687	0	24	0	0	0	0	1,843	0	0	188,861	189,831	0.2%
	Pp	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
	NF	-2,121,424	-1,933,743	-1,389	-4,355,622	0	-148,298	-428,075	-1,920,393	-1,592,789	-457,850	-121,797	0	-13,081,379	-15.3%
Total		-2,262,540	-2,098,032	-1,389	-4,345,828	15,011	-147,082	-432,138	-1,918,336	454,708	-403,961	-117,270	96,660,705	85,401,848	100.0%
		-2.6%	-2.5%	0.0%	-5.1%	0.0%	-0.2%	-0.5%	-2.2%	0.5%	-0.5%	-0.1%	113.2%	100.0%	

CO_2 Emission for 4 years from 2006 to 2010 without emissions from forest conversion to forest plantation	98,759,749	t CO_2
CO_2 Removal for 4 years from 2006 to 2010 without emissions from forest conversion to forest plantation	-13,416,317	t CO_2
CO_2 Emission / Removal for 4 years from 2006 to 2010 without emissions from forest conversion to forest plantation	85,343,432	t CO_2
Annual CO_2 Emission from 2010 to 2014	24,689,937	t CO_2/yr
Annual CO_2 Removal from 2010 to 2014	-3,354,079	t CO_2/yr
Annual CO_2 Emission / Removal from 2010 to 2014	21,335,858	t CO_2/yr

Annex 2 Description of land use/cover types

No	Land cover class	ID	Description
1	Evergreen forest	E	Areas covered by trees maintaining their leaves during the whole year.
2	Semi-evergreen forest	Se	Contain variable percentages of evergreen and deciduous trees.
3	Deciduous forest	D	Comprised of dry mixed deciduous forest and dry Dipterocarp forests
4	Bamboo	B	Areas dominated by bamboo
5	Wood shrub	Ws	Areas dominated by evergreen and deciduous woodland with a height less than 5 meters
6	Mangrove forest	M	Areas dominated by Mangroves i.e. coastal salt tolerant species
7	Rear Mangrove	Mr	Mostly growing in coastal zone after mangrove spp. Salt tolerant species but only infrequent floods
8	Rubber plantation	Rp	Areas currently supporting, and areas reserved for, rubber plantation
9	Flooded Forest	Ff	This forest type is found in Tonle Sap Lake. Most of the forests are low and disturbed. In many cases, there is only a mosaic remaining
10	Forest Regrowth	Fr	Areas of naturally regenerated forest where there are clearly visible indication of human activities such as selective logging, areas regenerating following agricultural land use, areas recovering from human induced fire, etc. • Include forest where it is not possible to distinguish whether planted or naturally regeneration. • Include forests with mix of naturally regenerated trees and planted/seeded trees, and where the naturally regenerated trees are expected to constitute more than 50 percent of the growing stock at stand maturity. • Include abandoned forest land and bare land which will regrow into forest within ten years
11	Pine Forest	P	The area dominated by coniferous trees which is natural pine forest
12	Pine plantation	Pp	The area domunated by pine tree plantation
13	Oil palm	Po	The area dominated by oil palm tree.
14	Tree plantation	Tp	This class includes the following type: teak, eucalyptus, acacia, jatropha and others.
15	Paddy Field	Hr	Paddy field is a flooded parcel of arable land used for growing semiaquatic rice.
16	Crop Land	Hc	This category includes arable and tillage land, and agro-forestry systems where vegetation falls below the thresholds used for the forest land category
17	Grassland	G	Grasslands are characterized as lands dominated by grasses rather than large shrubs or trees. It is crucial that the rainfall is concentrated in six or eight months of the year, followed by a long period of drought when fires can occur.
18	Built-up area	Bu	The patch of land with building and construction
19	Village	Bt	The patch of land with houses and garden surrounding house.
20	Rock	R	Land of naturally exposed rocks or strip mines, quarries and gravel pits.
21	Sand	S	In general, land of sand having thin soil or sand including deserts, dry salt flats, beaches, sand dunes.
22	Water	W	Area of fresh and sea water

Annex 3 Detailed methodology for acquiring activity data

1. Preparation of maps for FRL calculation

As of 2011 when Cambodia started its REDD+ readiness activities, maps showing forest cover of Cambodia were available for the year 1965, 1993, 1997, 2002, 2006 and 2010. Historically, the maps were made by interpreting satellite images printed on paper. From the 2002 map production, on-screen digitizing method using GIS software was introduced. The classification system and forest definition thresholds were not consistent for these maps (Brun, 2013)

Cambodia planned to establish its initial Forest Reference Level (FRL) by around September 2015 and in order to achieve this goal, development of a 2014 base map was initiated. For historical data existing maps were envisioned to be used as long as consistency could be warranted. These historical maps had the following issues as base for activity data for FRL establishment:

- The historical maps used various classification systems
- Before (2002) the forest cover threshold was 20% whereas the FRL forest definition is using a 10% threshold.
- Accuracy assessment was performed for the 2006 and 2010 maps only. That is, only these maps are suitable to be used in FRL establishment.
- Rubber and oil palm plantations, which are excluded from the Cambodia's forest definition for REDD+, were included in Other Forest class and were not separated in most historical data.
- Non-forest area is not stratified

To deal with these issues, the following measures were taken:

- Comparison of the classification and forest definitions used in historical maps and those used for FRL establishments
- Review land use/cover classes of 2006 and 2010 maps to make them consistent with six land use/cover categories defined by IPCC.
- Stratify Other Forest and Non-Forest classes of the 2006 and 2010 maps according to the new land use/cover classes and also exclude rubber and oil palm plantation classes from forest category.

2 Forest Definition for REDD+

The forest definition for REDD+ follows the definition of the National Forest Programme while rubber and oil palm plantation classes are excluded from the definition of forest. Forest under the REDD+ programme refers to a unit of an ecosystem in the form of wetland and dry land covered by

natural or planted vegetation with a height from 5 meters on an area of at least 0.5 hectares, and canopy crown cover of more than 10%. Area also included in the REDD+ programme are forest regrowth.

The land cover/use classification of Cambodia presents in 22 classes, including 9 classes of natural forests, 2 classes of plantation forest, 11 classes of non-forest, covering all 6 IPCC land use categories. Name of the 22 classes and description are in Annex 2 and the comparison of the land use class with the class of IPCCC category are show in the Table 1..

Table 1. Comparison of land use/cover classes

	Old (2006/2010) class		New class	IPCC guideline classification
1	Evergreen forest	1	Evergreen forest	Forest land
2	Semi-evergreen forest	2	Semi-evergreen forest	
3	Deciduous forest	3	Deciduous forest	
4	Bamboo	4	Bamboo	
5	Wood shrub dry	5	Wood shrub	Other land
6	Wood shrub evergreen			
7	Other forest	6	Mangrove forest	Forest land
		7	Rear mangrove	
		8	Rubber plantation	Cropland
		9	Flooded forest	Forest land
		10	Forest regrowth	
		11	Pine forest	
		12	Pine plantation	
		13	Oil palm	Crop land
		14	Tree plantation	Forest land
8	Non-forest	15	Paddy field	Cropland
		16	Crop Land	
		17	Grassland	Grassland
		18	Built-up area	Settlement
		19	Village	
		20	Rock	Other land
		21	Sand	
		22	Water	Wetland

The 22 land cover classes are based on physiognomy or biophysical appearance that are sensed by remote sensing data used (Landsat at 30m) and LCCS3 was used as a guiding tool to develop the classification.

3. Map production method

a. 2014 mapping

Unlike 2006 and 2010 mapping, all of the forest and non-forest areas were segmented for the 2014 mapping. The land use/cover classes of polygons generated by the segmentation process were identified by visual interpretation of LANDSAT images.

Several ancillary datasets (including boundary of forest plantation, Social Land concession, Economic land concession, and location of hydropower dams) were utilized during

the process of delineation, to catch additional information valuable for classification. Directive 001 land was classified as agricultural land because it was allocated for agricultural use, and SLC holders must abide by conditions that include development of the land through agricultural cultivation. The majority of lands have already been cleared, and it is reasonable to assume that all the Directive 001 land is converted to agricultural area in a very short period.

The procedure for the 2014 mapping is explained in Figure 1.

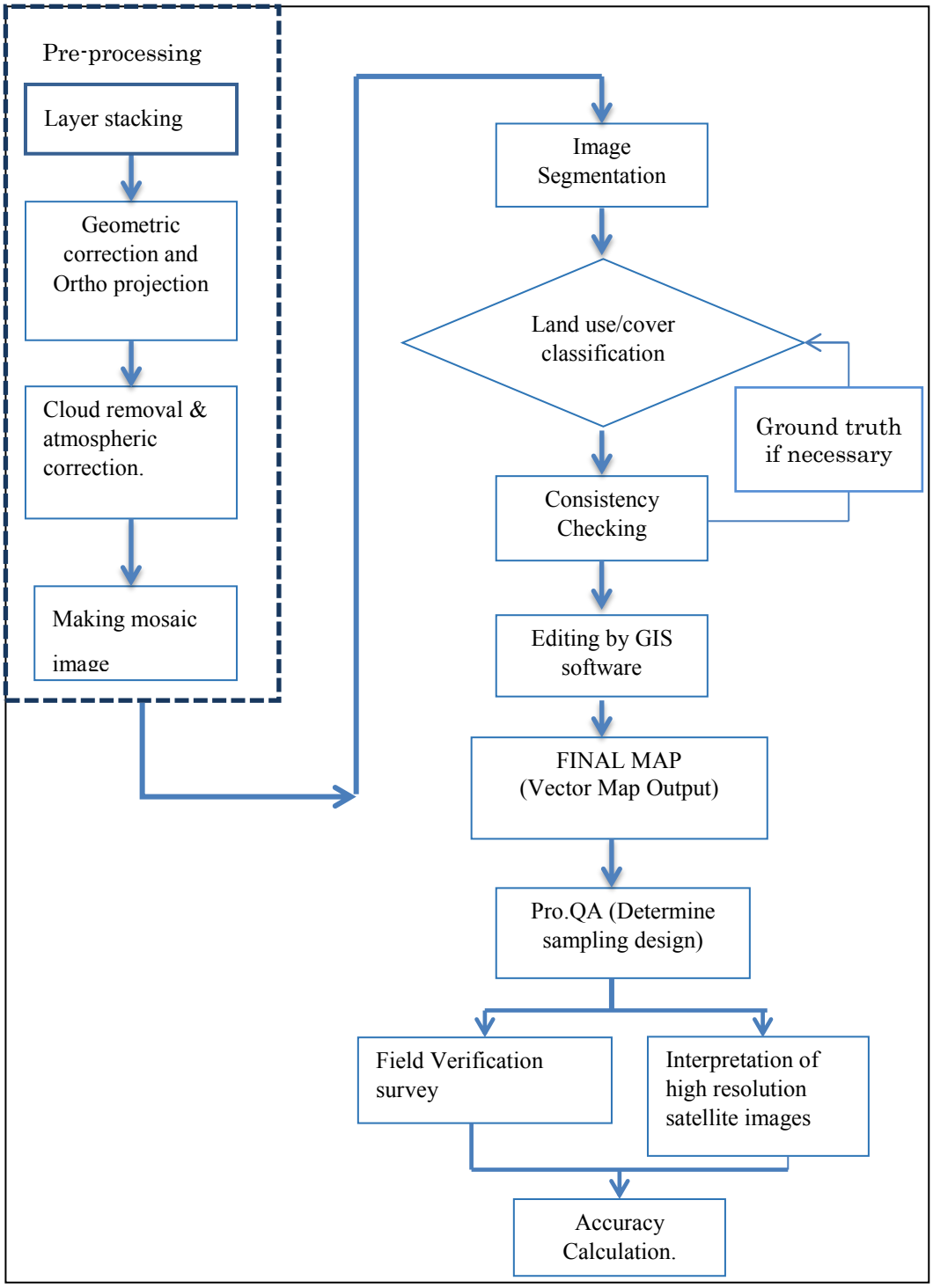

Figure 1: Procedure for develop Land Use/Cover 2014 Mapping

b. 2006 and 2010 map upgrading

"Other Forest" and "Non Forest" classes of original 2006 and 2010 maps were stratified according to newly defined land use/cover classes (Table 1) by using the same LANDSAT images used in the original mapping. In the stratification, segmentation technique was used. Land use/cover class of each segment (polygon) was identified by visual interpretation of LANDSAT images. Information such as map made by FAO and Mekong River Commission and images of GoogleEarth were also used as reference. Land use/cover class of minimum mapping unit (MMU) of Other Forest and Non Forest classes was 5ha while forest area data with a MMU of 25Ha was checked during correction stage to minimize inconsistency (See quality assurance and consistency).

Explanation Text: 1. Cambodia's forest definition was applied a minimum area of 0.5 hectares, but the minimum mapping unit for forest types was 5 hectares used in 2014 and 25 hectares in 2006 and 2010 by visual interpretation, it is impossible to identify from medium resolution satellite.

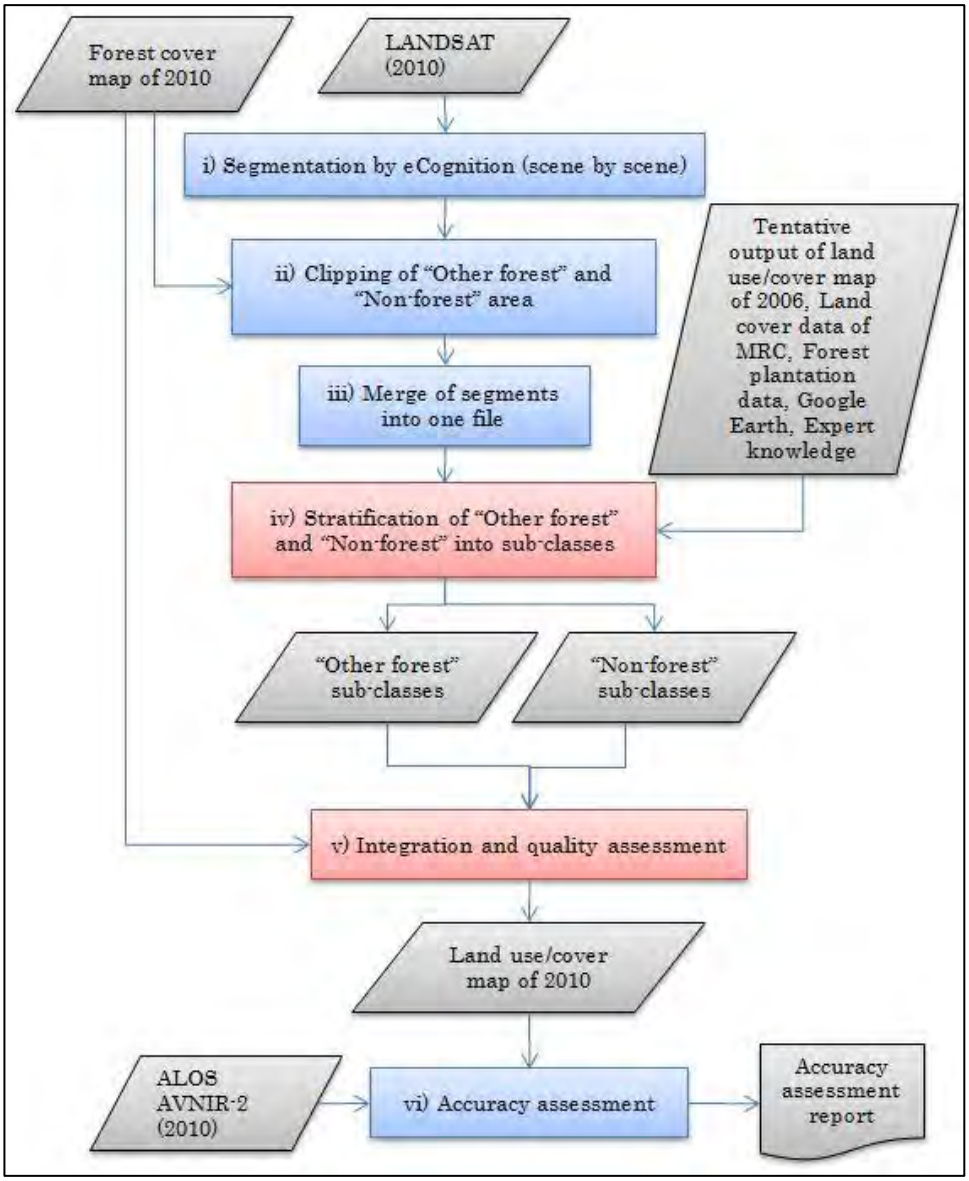

Figure 2: Procedure for upgrading Land Use/Cover 2010 Map

c. Quality assurance and consistency

New map of 2014 and upgraded maps of 2006 and 2010 were prepared for the purpose of obtaining land use/cover change information between 2006-2010 and 2010-2014. While the accuracy of each of the three maps is important, it is also important that land use/cover change information derived from the three maps is accurate.

To eliminate miss interpretation completely, thorough inspection of generated polygons is required. However, it is not practical to do this. Alternative method for checking is to identify land use/cover change patterns which are considered not likely and inspect land use/cover class of identified polygons. Process of land use/cover change pattern inspection is divided into three steps as shown in Figure 3.

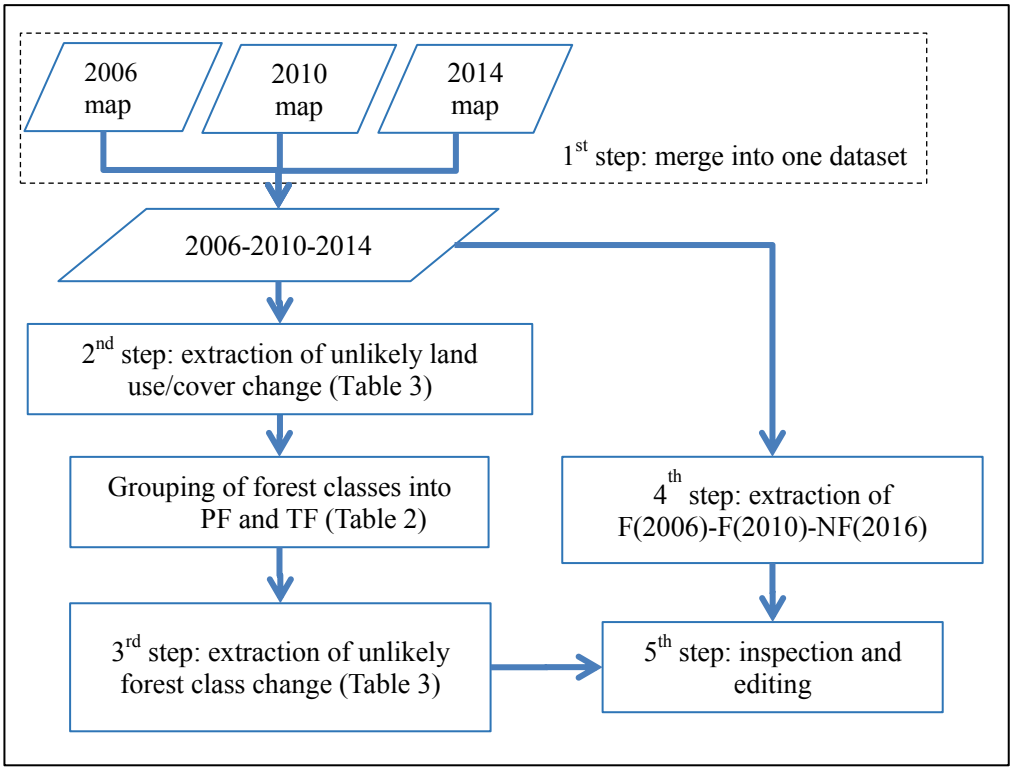

Figure 3: Procedure of quality assurance

In the 1st Step, map data of 2006, 2010 and 2014 were merged (intersected) into one file by using GIS.

In the 2nd Step, polygons with one of the following two land use/cover change pattern were selected.

F(2006)-NF(2010)-F(2014)
NF(2006)-F(2010)-NF(2014)

These two patterns were selected because it is unlikely that NF changes to F within a short period of time such as 4 years. However, if F is actually Forest Regrowth, NF to F change could be possible. So, for further inspection of land use/cover change, land use/cover classes belonging to Forest are divided into two groups as shown on Table 2.

Table 2. Grouping of forest classes into PF and TF

Permanent forest classes (PF)	Temporary forest classes (TF)
Evergreen forest (E)	Forest regrowth (Fr)
Semi-evergreen forest (Se)	Tree plantation (Tp)
Pine forest (P)	Rubber plantation (Rp)
Deciduous forest (D)	Oil palm plantation (Po)
Mangrove (M)	Pine plantation (Pp)
Rear Mangrove (Mr)	
Flooded forest (Ff)	
Bamboo (B)	

For the purpose of above grouping, Permanent Forest class is defined as those forests where their conditions continue for a long time if there are no anthropogenic or natural disturbances. Temporary Forest class is defined as those forests where their conditions change in relatively short period such as a few years to a few decades.

Then, as shown on Table 3, F-NF-F and NF-F-NF patterns were divided into 6 sub-patters. And among the 6 land use/cover change patterns, 3 patterns were considered as unlikely change. And, polygons which belong to one of these 3 patterns were extracted. The extracted polygons were stratified by the decision criteria, and the classes of polygons were inspected and corrected based on the class assignment procedure set for each decision criterion.

Table 3. Pattern of unlikely land use/cover change

Forest (F)/ non-forest (NF) change	Forest type change	Unlike liness	Decision criteria	Decision	Class assignment procedure	Magnitude		
						No. of polygon	Total area (ha)	% of country area
F(2006)-NF(2010)-F(2014)	PF(2006)-NF(2010)-PF(2014)	Yes	Permanent forest class of 2006 and 2014 coincides or not?	Yes	Replace NF(2010) with an attribute of permanent forest class of 2006 & 2014	71,489	18,224	0.1%
				No	An attribute of permanent forest class of 2014 is copied to 2006 and 2010 assuming that classification of 2014 is the most accurate and permanent forest class did not change between 2006 and 2014.	13,682	3,645	0.0%
	TF(2006)-NF(2010)-PF(2014)	Yes	Polygon area ≧5ha or not?	Yes	Check satellite imagery and edit attributes of 2006, 2010 and 2014.	36	331	0.0%
				No	An attribute of permanent forest class of 2014 is copied to 2006 and 2010 assuming that classification of 2014 is the most accurate and permanent forest class did not change between 2006 and 2014.	1,799	477	0.0%
	TF(2006)-NF(2010)-TF(2014)	No						
	PF(2006)-NF(2010)-TF(2014)	No						
NF(2006)-F(2010)-NF(2014)	NF(2006)-PF(2010)-NF(2014)	Yes	Polygon area ≧5ha or not?	Yes	Check satellite imagery and edit attributes of 2006, 2010 and 2014.	2,980	27,505	0.2%
				No	Non-forest class of 2014 is copied to 2010.	103,149	34,928	0.2%
	NF(2006)-TF(2010)-NF(2014)	No						

In the 3rd step, change patterns F(2006) – F(2010) – F(2014) were divided into 8 sub-patterns and 4 of them were labeled as unlikely change as shown in Table 4. And, polygons which belong to one of these four patterns were extracted. The classes of extracted polygons were inspected and corrected based on the class assignment procedure set for each unlikely forest type change.

Table 4. Pattern of unlikely change among forests

Permanent forest (PF)/ Temporary forest (TF) change	Forest type change	Unlike liness	Class assignment procedure	Magnitude		
				No. of polygon	Total area (ha)	% of country area
F(2006)-F(2010)-F(2014)	PF(2006)-TF(2010)-PF(2014)	Yes	An attribute of permanent forest class of 2014 is copied to 2006 and 2010 assuming that classification of 2014 is the most accurate and permanent forest class did not change between 2006 and 2014.	8,593	6,337	0.0%
	TF(2006)-TF(2010)-PF(2014)	Yes		14,515	42,668	0.2%
	TF(2006)-PF(2010)-PF(2014)	Yes		2,731	873	0.0%
	TF(2006)-PF(2010)-TF(2014)	Yes	An attribute of temporary forest class of 2014 is copied to 2010 assuming that classification of 2014 is the most accurate.	1,765	1,338	0.0%
	PF(2006)-PF(2010)-TF(2014)	No				
	PF(2006)-TF(2010)-TF(2014)	No				
	TF(2006)-TF(2010)-TF(2014)	No				
	PF(2006)-PF(2010)-PF(2014)	No				

Inconsistency among non-forest classes was not checked because, for the calculation of initial FRL of Cambodia, carbon stock of non-forest classes was considered as zero.

There are two possible reasons for unlikely changes. One is miss interpretation of satellite images. The other is caused by different Minimum Mapping Units (MMU) used in new 2014 map and those used in upgraded 2006 and 2010 maps. MMU of the 2014 map is 5ha while the MMU of 2006 and 2010 map for forest land was 25ha. As shown in Figure 4, a small patch of land which is less than 25ha and larger than 5ha could not be captured in 2006 and 2010 maps but captured in 2014 map. In the inspection and correction stage the use of different MMU was considered as a potential cause of unlikely change.

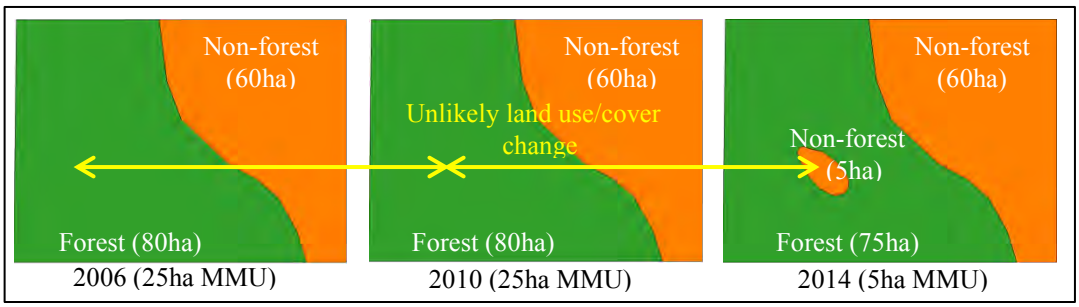

Figure 4. Unlikely land use/cover change caused by inconsistent MMU

In the 4th Step, target of inspection was F(2006)-F(2010)-NF(2014) change pattern. This is because there was possibility that small openings (non-forest areas) within forest class were not identified on 2006 and 2010 maps because of larger MMU.

First, Non-Forest areas on 2014 map were selected. Then, the selected Non-Forest areas which were classified as Forest on 2006 and 2010 maps were extracted. And among the extracted areas, areas which could be Non-Forest were identified by using Normalized Difference Vegetation Index (NDVI). And finally, 2006 and 2010 land use/cover class of the identified areas was determined by interpreting LANDSAT images.

F(2006-PF)-F(2010-PF)-NF (2014) :The area of NF class (<25ha and >5ha) in year 2014 were selected. Then, the selected Non-Forest areas which were classified as Forest on 2006 and 2010 maps were extracted. And among the extracted areas, areas which could be Non-Forest were identified by using Normalized Difference Vegetation Index (NDVI) generated from LANDSAT (resolution 0.09 ha) used in the mapping. And finally, 2006 and 2010 land use/cover class of the identified areas was determined by interpreting LANDSAT images.

Note: If identified land is more than 5ha, then, LANDSAT images of 2006, 2010 and 2014 were checked and correction of land use/cover class was made if necessary. If the size of the identified land is less than 5ha, they were corrected automatically based on the class assignment procedure set for

each land use/cover change pattern.

4. Accuracy Assessment

a. 2006 map

Accuracy assessment of the original 2006 forest assessment map was performed by Geographic Resource Analysis & Science A/S (GRAS). The report was compiled as Accuracy Assessment Report (draft final) (2007). Overall accuracy of the five classes – Evergreen Forest, Semi-evergreen forest, Deciduous Forest, Other Forest and Non-Forest, was 74%.

b. 2010 map

Accuracy assessment of the original 2010 forest assessment map was performed by GRAS. Overall accuracy was around 85%. After upgrading of the 2010 map and initial editing the Forestry Administration continued to check consistency among the three maps – 2006, 2010 and 2014 – and made necessary correction. The accuracy assessment was performed after the completion of consistency check and editing.

Number of accuracy assessment points was calculated by using a formula of Congalton & Green (Congalton, R. G. and Green, K., 2009) presented below.

$$n = B/4b^{\wedge}2$$

where

Confidence level (95%)	α	0.05
Number of class	κ	22
upper (α/κ) x 100th percentile of the $\chi 2$ distribution with 1 degree of freedom	B	9.3151
Desired precision	b	5% (0.05)

hence

$$n = B/4b^{\wedge}2 = 9.3151 / 4 \times (0.05)^{\wedge}2 = 932$$

While the calculated total number of the point was 932 minimum 50 points were assigned for each class where possible.

First, total 932 points were distributed to each land use/cover class in proportion to the area of each class. And minimum number of the assessment points was set as 50. If calculated number of the assessment point was less than 50, it was replaced by 50 to determine temporary number of the points.

On the other hand, Forestry Administration decided that accuracy assessment points should be selected among from national forest inventory (NFI) points, which cover Cambodia in a systematic way with a fixed distance. Based on this condition, number of NFI points included in each land use/cover class was calculated and compared with the temporary number of the points.

If the number of NFI point is less than the temporary assigned number, it was replaced by the number of NFI points. Table 4 shows the number of the calculated accuracy assessment points. As the result of the adjustment described above, total number of the accuracy assessment point was 1233.

Table 4 Accuracy assessment points for each land use/cover class for 2010 map

Class	Area (km2)	%	Calculated Number of points	Temporary number	NFI Point included in polygon	Final Number of points
Bamboo	1,280.99	0.71%	7	50	40	40
Village	2,948.46	1.62%	15	50	108	50
Built up area	437.03	0.24%	2	50	14	14
Deciduous	45,115.69	24.84%	232	232	1234	230
Evergreen	36,512.05	20.11%	187	187	1018	183
Flooded forest	5,126.93	2.82%	26	50	306	50
Forest regrowth	2,534.33	1.40%	13	50	70	50
Grass land	5,132.26	2.83%	26	50	238	50
Agriculture	11,824.51	6.51%	61	61	379	65
Paddy field	38,466.57	21.18%	197	197	1530	198
Mangrove	314.43	0.17%	2	50	34	40
Rear mangrove	274.36	0.15%	1	50	30	29
Pine forest	81.29	0.04%	0	50	2	2
Oil palm	50.35	0.03%	0	50	3	3
Rock	6.92	0.00%	0	50	0	
Rubber	1,117.87	0.62%	6	50	32	36
Sand	100.04	0.06%	1	50	4	4
Semi-evergreen	14,132.79	7.78%	73	73	398	71
Tree plantation	170.61	0.09%	1	50	7	5
Water	4,561.38	2.51%	23	50	236	50
Wood shrub	11,392.86	6.27%	58	58	426	58
	181,590.57	100.00%	932		6105	1,233

For the selected accuracy assessment points, their land use/cover class was interpreted on AVNIR2 images of ALOS satellite. Then, the result of the interpretation was compared to the land use/cover class of the upgraded 2010 map. The overall accuracy assessment of upgraded 2010 map is 73.97% with the kappa accuracy is 70.98%. The result of the accuracy assessment is summarized as a confusion matrix as presented in Table 5.

Table 5 Confusion matrix of upgraded 2010 map

Land use/cover classes		Verificaiton Result																				
		E	Se	P	D	Fr	B	M	Mr	Ff	Tp	Rp	Po	Hc	Hr	G	Ws	W	Bu	Bt	S	Sum	User Acc.
Classification on Map	E	165	8		1	1						1		4		1	2					183	90.16%
	Se	15	34		12	1								7		1				1		71	47.89%
	P			2																		2	100.00%
	D	8	31		169									13	1	2	5			1		230	73.48%
	Fr	3				29								5	2	1	10					50	58.00%
	B	12	1			5	15							1	1	1	9					45	33.33%
	M							36							1		1	2				40	90.00%
	Mr					1		4	20						1	1		2				29	68.97%
	Ff									39					1	5	5					50	78.00%
	Tp										5											5	100.00%
	Rp					1						33		1						1		36	91.67%
	Po												2	1								3	66.67%
	Hc				2							1		50	6		4			2		65	76.92%
	Hr				1	1								7	169		3	2		15		198	85.35%
	G	2	1							1				5	4	30	2	5				50	60.00%
	Ws	1			5	1				2				12	8	3	25			1		58	43.10%
	W									1					2		2	45				50	90.00%
	Bu													1	1	1			11			14	78.57%
	Bt					1								1	16		2			30		50	60.00%
	S					1															3	4	75.00%
	Sum	206	75	2	190	42	15	40	20	43	5	35	2	108	213	46	70	56	11	51	3	1233	16.71%
	Prod.Acc.	80%	45%	100%	89%	69%	100%	90%	100%	91%	100%	94%	100%	46%	79%	65%	36%	80%	100%	59%	100%		

c. 2014 map

Just like the accuracy assessment of the upgraded 2010 map, total number of accuracy assessment points was calculated by using the same Congalton & Green formula and then they were distributed for each class in proportion to the area of each class. Then, actual number of the points was adjusted in the same manner with the 2010 map accuracy assessment. Total number is 1252. Their location is shown in Figure 4.

All procedures in the sampling strategy follow the methodology described by Congalton & Green (1999, 2009), which is the most commonly used procedure for accuracy assessment of maps derived from remote sensing.

A summary table of the sample selection has shown in Table 6.

212 of the 1252 points were visited in the field. Remaining 527 points were checked on satellite images – 165 on Rapid Eye images, 527 using Google Earth high resolution images and 348 by careful visual interpretation of LANDSAT8 images.

Table 6: Summary of samples used in the accuracy assessment of the 2014 land use and land cover assessment

ID	Class LU/LC	Area		Number of sample				
		Ha	%	Field Collection	Google earth	Rapid eye	Landsat 8	Total
1	Evergreen Forest	3018031	16.62%	1	36	43	73	153
2	Semi Evergreen forest	1146937	6.32%	2	23	10	24	59
3	Deciduous Forest	3662553	20.17%	14	65	32	80	191
4	Pine Forest	8161	0.04%			2		2
5	Flooded Forest	478768	2.64%	6	29	7	5	47
6	Bamboo	137852	0.76%	4	15	4	17	40
7	Forest Regrowth	245348	1.35%	8	26	1	11	46
8	Mangrove	32898	0.18%	2	14	15	5	36
9	Rear mangrove	27072	0.15%	1	7	14	3	25
10	Pine Plantation	3751	0.02%	1	1		1	3
11	Tree Plantation	49237	0.27%	10	2		4	16
12	Oil Palm Plantation	34107	0.19%		2	1	9	12
13	Rubber Plantation	482822	2.66%	15	10	7	18	50
14	Paddy field	4122259	22.70%	72	120	4	20	216
15	Agriculture	2538572	13.98%	24	60	11	38	133
16	Wood shrub	629303	3.47%	12	19	5	9	45
17	Village	339941	1.87%	20	24	1	2	47
18	Built up area	42864	0.24%	11	3		0	14
19	Grassland	345826	1.90%	5	22	4	15	46
20	Rock	2141	0.01%				1	1
21	Sand	44311	0.24%	2	9	2	3	16
22	Water	767932	4.23%	2	40	2	10	54
	Total area	**18160674**	**100%**	**212**	**527**	**165**	**348**	**1252**

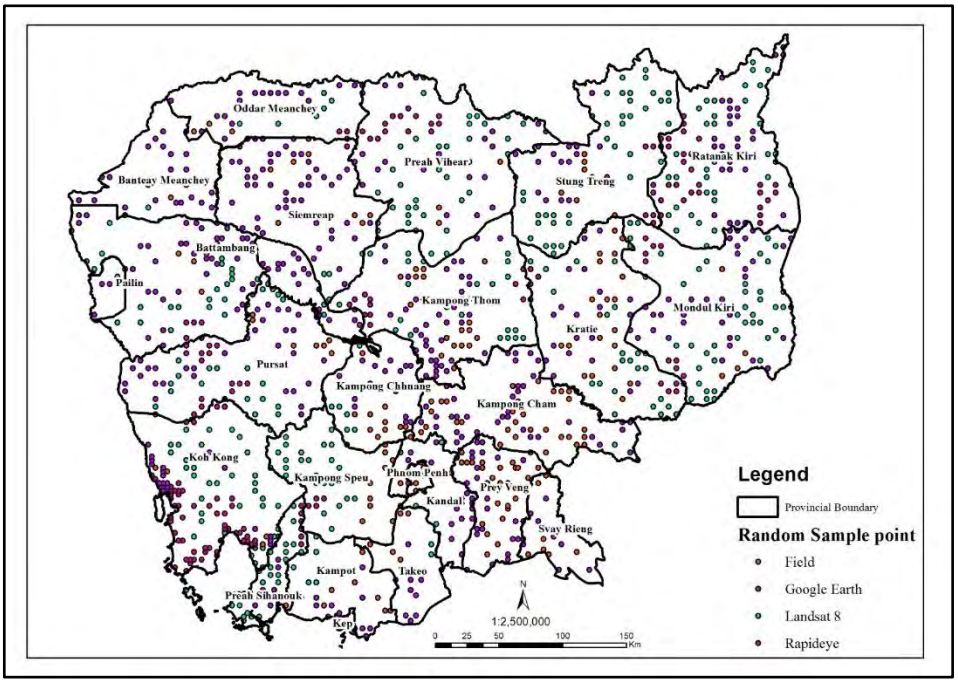

Figure4: Map of random sample 1252 points for accuracy check land use /land cover 2014

In total, 201 of the planned 212 points were visited in the field. The reason for the visited points being lower than the planned points was due to restricted access (9 cases), Seven of these points were situated in the flooded forest area which could not be reached due to extended dry season which prevented access by boat and two points were situated in prohibited area (Military station and economic land concession). The distribution of the field samples covered 22 provinces out of 24 (Table 7).

Table7: Summary of random sample point assess by province

No	Province	Point	Assess point
1	Kampong Spueu	10	9
2	Kaoh Kong	4	4
3	Krong Preah Sihanouk	1	1
4	Krong Kaeb	1	1
5	Kampot	7	7
6	Takaev	5	5
7	Kandal	8	8
8	Bat Dambang	5	4
9	Pousat	14	9
10	Kampong Chhnang	14	12
11	Phnom Penh	8	8
12	Kampong Cham	31	9
13	Kampong Thom	20	19
14	Preah Vihear	3	3
15	Otdar Mean Chey	3	3
16	Banteay Mean Chey	2	2
17	Siem Reap	9	9
18	Stueng Traeng	6	6
19	Kratie	22	21
20	Mondol Kiri	4	4
21	Prey Veaeng	28	28
22	Svay Rieng	7	7
TOTAL		212	201

Assessment of land use/cover consistency between field verification data collected in 2015 and Landsat image of 2014

1 year had elapsed between satellite image acquisition and field survey. So, it was necessary to check whether the site had changed during the one year period in order to verify the result of field survey for accuracy assessment.

For the purpose of this verification, Landsat 8 images of the year 2014 and 2015 were compared as shown in Figure 5. In Figure 5, the land cover class observed during field survey differed from the land cover class interpreted on 2014 satellite image. Therefore, this field verification data was excluded from the samples of accuracy assessment.

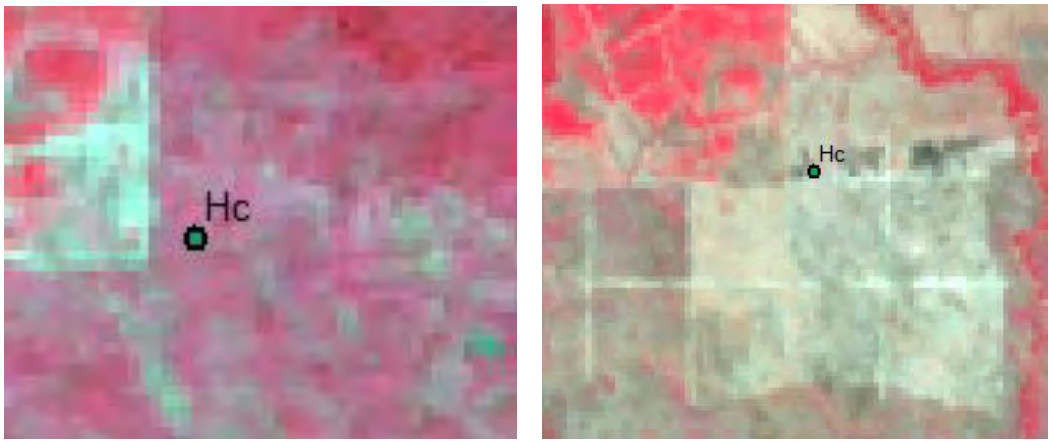

Figure5: Landsat image 2014 Landsat image 2015

The result of the accuracy assessment on land use and land cover 2014 is shown in Table 8.

Table 8 Confusion Matrix of 2014 map

LU/LC classes		Field sample																						
		BB	Bt	Bu	D	E	Ff	Fr	G	Hc	Hr	M	Mr	P	Po	Pp	R	Rp	S	Se	Tp	W	Ws	Sum	User acc.
Classified	BB	25				8				3										3			1	40	62.5%
	Bt		42							2	3													47	89.4%
	Bu		1	8															3				2	14	57.1%
	D	3			147			2	3	3	2									22			9	191	77.0%
	E				4	139		1	1	2										5			1	153	90.8%
	Ff						46															1		47	97.9%
	Fr		1				2	37	1	3	1												1	46	80.4%
	G				1		1		32	3	3								1			1	4	46	69.6%
	Hc		1		6			2	2	102	4		1					3	1			3	8	133	76.7%
	Hr	1	7	1	1				1	2	196								1			3	2	216	90.7%
	M										1	29	4									1	1	36	80.6%
	Mr											5	19									1		25	76.0%
	P													2										2	100.0%
	Po											1			11									12	91.7%
	Pp								1							2								3	66.7%
	R																1							1	100.0%
	Rp								2	4								44						50	88.0%
	S								1	1	1								10			2	1	16	62.5%
	Se	1			5					2	1									45		1	4	59	76.3%
	Hc				1					3											11		1	16	68.8%
	W		1	1			2		1		3											46		54	85.2%
	Ws		1		4	2	1	3	4	2	1	1									1	2	23	45	51.1%
	Sum	30	54	10	169	149	52	45	49	132	216	36	24	2	11	2	1	47	16	75	12	61	58	1252	
	Sum Prod. Acc	83.33%	77.78%	80.00%	86.98%	93.29%	88.46%	82.22%	65.31%	77.27%	90.74%	80.56%	79.17%	100.00%	100.00%	100.00%	100.00%	93.62%	62.50%	60.00%	91.67%	75.41%	39.66%		

The overall accuracy with respect to the combination of field verification and high resolution images is 81.23% with user's accuracy is 78.70, producer's accuracy is 82.17% and Kapa accuracy is 79.49%. The accuracy showed lowest results in the Wood shrub and grass land classes. Some of these errors are inevitable given the difficulties of separating certain classes, e.g. deciduous forest from wood shrub.

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Annex 4 Detailed methodology for acquiring AGB values for emission factors

Introduction

For the purpose of compiling a national Greenhouse Gas inventory for the forestry sector and also of establishing a national forest reference level (FRL)[5] for REDD+, volume of carbon sequestrated in five carbon pools in the forest need to be estimated. In Cambodia, various forest inventory surveys have been carried out. However, nationwide systematic forest inventory survey has not yet been implemented.

In the absence of nationwide data on forest carbon, carbon stock for each forest type of Cambodia need to be estimated based on available data sources. First, JICA Technical Assistants Team carried out a literature survey to identify value of biomass density of each forest type of Cambodia. On the other hand, under UN-REDD program FAO collected raw data of various forest inventory surveys implemented in Cambodia and analyzed values of biomass density (Sola et al., 2014).

Based on these works, values of forest biomass density to be used in GHG inventory and FRL establishment for Cambodia were selected. Additional literature survey was conducted for searching regional data if suitable country specific values were not found in the two works mentioned above. This paper explains the process of the selection and selected values. Since the data other than Above Ground Biomass (AGB) are rather limited for Cambodia, this paper focuses only on AGB.

1 Recommended AGB values for Emission Factors

Recommended values of AGB for each forest type are summarized in

[5] Forest Reference Level is a benchmark for assessing each country's performance in implementing REDD+ activities which is expressed in tons of carbon dioxide (CO2) per year. Forest biomass can be converted to carbon volume and then to the CO2 volume by using existing formulas.

Table 1. All land use/cover types other than forest category used in present land use/cover mapping by Forestry Administration are also shown. The area and ratio of major forest types of Cambodia as of 2010 is summarized in Table 2. As Table 2 shows, three principal forest types, i.e. Evergreen, Semi-evergreen and Deciduous forests, occupy 90.54% of entire forest land of Cambodia. Since AGB values of these three forest types are country specific, emission factors of Cambodia's forest could be substantially considered as Tier 2 level.

Table 1 Recommended unit AGB values

Land use/cover			Recommended AGB (t/ha)	Data source*	References Used for
Category		Sub-category			
Forest land	Natural forest	Evergreen	163	Country specific	UN-REDD (2014)
		Semi-evergreen	243	Country specific	UN-REDD (2014)
		Deciduous	85	Country specific	UN-REDD (2014)
		Pine forest	100	IPCC Default	IPCC (2003), MoE/UNDP (2003)
		Bamboo	0	-	(Nil)
		Mangrove	150	Regional	MoE/UNDP (2003)
		Rear mangrove	165	Regional	Tran (2015)
		Flooded forest	70	IPCC Default	MoE, 2002, MoE/UNDP (2003)
		Forest regrowth	75	Country specific	CFI (2008) cited in Sar (2010)
	Planted Forest	Pine plantation	100	IPCC Default	IPCC (2003), MoE/UNDP (2003)
		Tree plantation	100	IPCC Default	IPCC (2003), MoE/UNDP (2003)
Cropland		Rubber plantation	43**	Country specific	Toriyama et.al. (2011)
		Oil palm plantation	42**	Regional	Kotowska et.al (2015)
		Cropland	-	-	-
		Paddy field	-	-	-
Grass land		Grass land	-	-	-
		Wood shrub	-	-	-
Wetland		Water	-	-	-
Settlement		Village	-	-	-
		Built-up area	-	-	-
Other land		Rock	-	-	-
		Sand			

* Country specific: based on studies of forest in Cambodia, Regional: based on the study in neighbor countries in Southeast Asia

** These figures of Rubber plantation and Oil palm plantation were not used in the initial FRL calculation.

Table 2 Forest cover in Cambodia (2010)

Forest Type	Area (ha)	Ratio (%)
Evergreen forest	3,573,437	34.19
Semi-evergreen forest	1,391,117	13.31
Deciduous forest	4,498,397	43.04
Other forest	988,472	9.46
Total forest land	10,451,423	100.00

90.54% of total forest land

Source: Cambodia Forest Cover 2010 (Kingdom of Cambodia, 2011)

2 Selection of an AGB value for each forest type

First of all, in Cambodia, forest is classified into 11 types as shown in Table 1. In this chapter, the reasons for the selection of an AGB value for each forest type are explained. Section 2.1 is dedicated to Evergreen, Semi-evergreen, and deciduous Forests, Section 2.2 is for the other forest types, and Section 2.3 is for rubber and oil palm plantations.

2.1 Above Ground Biomass for Evergreen, Semi-evergreen, and deciduous Forests

2.1.1 Data source examined for selecting the values

1) Initial National Communication (INC) of Cambodia (MoE, 2002)

This is the official document of Cambodia submitted to UNFCCC in 2002. The document used default AGB values provided in the Revised 1996 Guidelines for National GHG Inventories (IPCC, 1997).

2) CCEAP Phase 2, final report (MoE/ UNDP, 2003)

Cambodia Climate Change Enabling Activity Project (CCEAP) was carried out to assist Cambodia to prepare an initial National Communication. One of the objectives of Phase 2 of the project was to improve activity data and emission factors used in the INC so that better figures would be used in the future National Communications. Activity data and emission factors identified in the report were used in the second National Communication which is planned to be submitted to UNFCCC in the near future.

In this report, AGB values were collected from two sources. One is a field survey carried out by the CCEAP project in 14 sample plots in seven sites. The other is the results of forest biomass studies conducted in the past in the region of South East Asia.

3) Forest biomass in Cambodia (Sola et al., 2014)

In the past, Cambodian government carried out forest inventory surveys at various locations in collaboration with different institutions. Under UN-REDD program, FAO collected part of the raw data of these forest surveys - 40 permanent sample plots (PSP), 668 plots of REDD+ related projects, and 1,047 plots in Community forests - and harmonized them to create allometric equations and estimate unit AGB values for different forest types (UN-REDD, 2014, unpublished). The location of each plot is shown in in Figure 1.

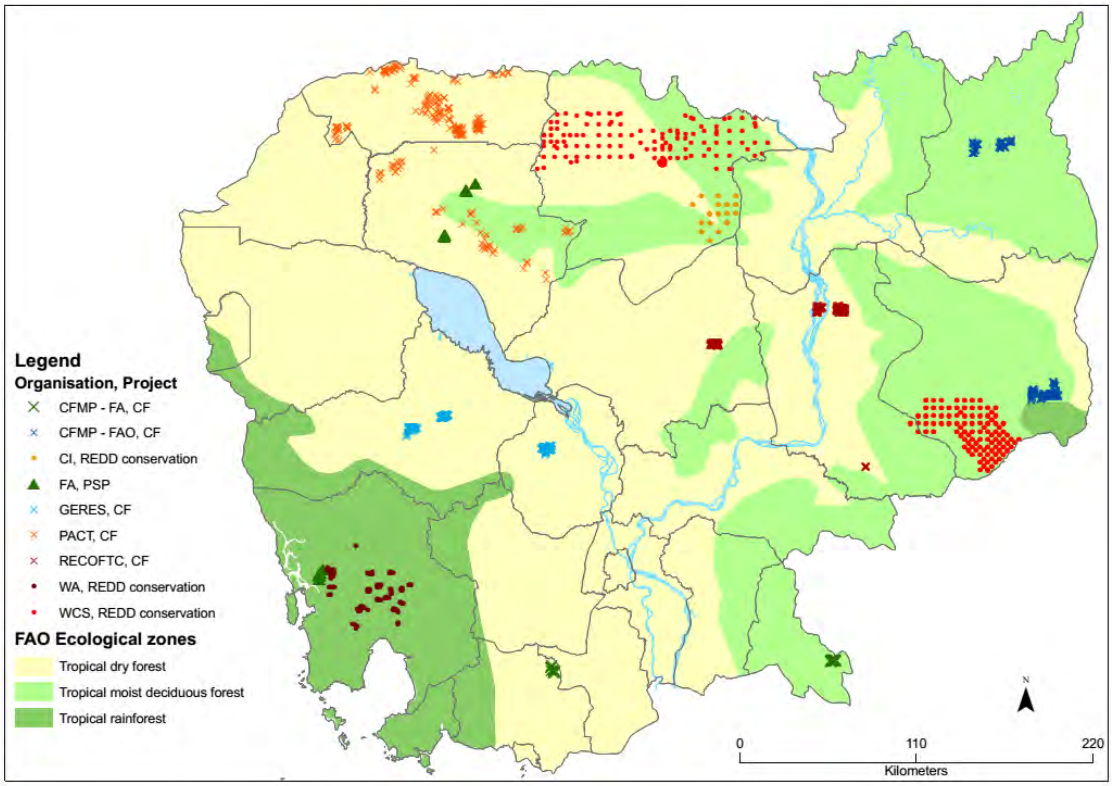

Figure 1: Location of forest inventories used in UN-REDD (2014) (Cited from Sola et al. 2014)

Under those efforts, the values of AGB for Evergreen, Semi-evergreen, and deciduous Forests are calculated by using the data of 39 permanent sample plots (PSP), 474 plots of REDD+ related projects, and 528 plots in Community forests for which the authors of this UN-REDD paper judged that those data were collected in those three forest types. The results are not explicitly shown in the paper. Therefore the values were re-calculated using the back data of this paper of UN-REDD which were offered by one of the authors with his courtesy. Table 3 is the result if the re-calculation.

In Table 3, values in the column of "Average AGB value in each study" are those calculated for each of PSP, REDD+ project plots and community forestry plots (columns (a), (b), and (c)). "n" means the number of plot used for the calculation. Columns (d) and (e) are the average of AGB values of PSP, REDD+ project plots and Community Forestry plots by different combination.

Table 3 Summary of AGB values identified in UN-REDD (2014)

Forest type	Average AGB value in each study*			**(d)** Average of (a) + (b)	**(e)** Average of (a)+(b)+(c)
	(a) PSP (n=39)	**(b)** REDD (n=474)	**(c)** CF (n=528)		
Evergreen	325 t/ha (n= 35)	232 t/ha (n= 270)	47 t/ha (n= 210)	243 t/ha (n= 305)	163 t/ha (n= 515)
Semi-evergreen	- -	356 t/ha (n= 54)	51 t/ha (n= 32)	356 t/ha (n= 54)	243 t/ha (n= 86)
Deciduous	100 t/ha (n= 4)	193 t/ha (n= 150)	29 t/ha (n= 286)	190 t/ha (n= 154)	85 t/ha (n= 440)

* PSP: permanent sample plots, REDD: REDD+ related projects, CF: Community forests.

** The values are calculated from back data of UN-REDD (2014)

*** Only the values of (c) and (d) are shown in UN-REDD (2014). Moreover, the values are slightly different from those calculated from back data. This is the reasons why the value was re-calculated from the back data.

2.1.2 Selection of the values of unit AGB

In order to select recommendable values of unit AGB, those used in the INC of Cambodia (MoE, 2002), those identified in CCEAP (MoE/ UNDP, 2003), and those from UN-REDD (2004) were shown in Table 4.

Table 4: Comparison of AGB values of three main forest types (ton/ha)

Forest type	INC (MoE, 2002)	CCEAP (MoE/UNDP, 2003)	UN-REDD (2014)	
			Average of PSP and REDD	Average of PSP, REDD and CF
Evergreen	295	200	243	163
Semi-evergreen	370	250	356	243
Deciduous	120	100	190	85

The data sets of UN-REDD (2014) are acquired from raw data of forest inventory survey. Therefore, traceability and transparency of the data for acquiring those values are much higher than the other two. Moreover, the values in UN-REDD (2014) are suitable for Tier 2 level GHG inventory because all of the data used are acquired by field survey conducted in Cambodia.

Among two datasets of UN-REDD (2014), the values of "average of PSP and REDD+ related project" is higher than those of CCEAP (MoE/UNDP, 2003) for all of the three forest types. As a figure in Annex I shows, most of PSP and REDD+ related project plots are located in protected areas or protected forests with high biomass density forest. Therefore, the average of only PSP and REDD+ related project plots might result in the overestimation for a national scale AGB.

In the sense of avoiding overestimation, the averaged AGB using all available data of PSP, REDD+ related project plots and community forest plots is more recommendable, although it might result in underestimation of AGB to the contrary because quantity of data collected from Community forest plots was larger than those collected from PSP and plots of REDD+ related projects. This is considered as being conservative.

As a result, selected AGB values of Evergreen forest, Semi-evergreen forest and Deciduous forest are 163 t/ha, 243 t/ha and 85 t/ha, respectively.

2.2 Above Ground Biomass for other forest types

There are eight other forest types in the land use/cover classification of Cambodia REDD+. Those are Pine Forest, Bamboo, Mangrove, Rear Mangrove, Flooded Forest, Forest regrowth, Pine plantation and Tree plantation.

2.2.1 Pine forest

For Pine forest AGB, only one data source was found. CCEAP (MoE/UNDR, 2003) conducted a field study at two plots in Cambodia, and the ABG is calculated as 57 t/ha and 102 t/ha respectively, which average is 80t/ha. Any other studies in South East Asia on Pine forest AGB have not been found. Since only two data are not sufficient to estimate appropriate value of Pine forest AGB, 100 t/ha, the value selected for Pine plantation is substituted for Pine forest AGB.

2.2.2 Bamboo

The distribution of bamboo is very limited in Cambodia, hence, it is not significant sink/source of carbon. No value of bamboo is presented neither in INC (MoE, 2002) nor CCEAP (MoE/UNDP, 2003). Any country specific Bamboo AGB is not found by us except one data from uncertain source, which presents 77 t/ha. Some regional data was found, however, it is rather difficult to justify that those regional values are appropriate for Bamboo AGB of Cambodia. Considering this information Bamboo AGB is set to zero.

2.2.3 Mangrove

Mangrove AGB used in INC (MoE, 2002) and selected in CCEAP (MoE/UNDP, 2003) are 175 and 150 t/ha, respectively. CCEAP (Moe/UNDP, 2003) also shows the result of a field study on Mangrove biomass conducted at two plots in Cambodia, and the ABG is calculated as 89 t/ha and 198 t/ha respectively, which average is 144t/ha.

According to JICA Technical Assistants Team (2015), the range of Mangrove AGB from eight studies conducted in neighbor countries varies from 92 t/ha to 299 t/ha.

Under the circumstances of limited information of country specific data, it is considered to be reasonable to use the same value identified in CCEAP (Moe/UNDP, 2003) for Mangrove forest, that is 150 t/ha.

The Fisheries Administration (FiA) under Ministry of Agriculture, Forestry and Fisheries (MAFF) of Cambodia has implemented field survey of mangrove forest in 2015 with the assistance of USAID. The Mangrove AGB could be updated based on that result when it comes out.

2.2.4 Rear mangrove

Rear Mangrove forest is mainly composed of *Melaleuca leucadendron* in Cambodia (Theilade et al., 2011). No value of Rear mangrove is presented neither in INC (MoE, 2002) nor CCEAP

(MoE/UNDP, 2003).

Only one study found for Rear mangrove of Cambodia is Hozumi et.al. (1969). AGB shown in the study is 13 t/ha. Since only one plot was surveyed in Hozumi et.al. (1969) and this value seems to be very low, it is rather hesitated to select this value as Rear mangrove AGB of Cambodia, although this value is country specific.

Another study found for Melaleuca biomass in the region is Tran, D.B., (2015). This study was conducted for M. cajuputi forest in Phu Quoc National Park along the coast of Vietnam close to Cambodia. As it is a study for a taxonomically very close species and the growing environment is assumed to be similar to that of Cambodia, the value in Tran, D.B. (2015), 165 t/ha (the range is 48 – 235 t/ha), is recommended to be used for Rear Mangrove AGB.

2.2.5 Flooded forest

Flooded forest AGB both used in INC (MoE, 2002) and selected in CCEAP (MoE/UNDP, 2003) is 70 t/ha.

CCEAP (MoE/UNDP, 2003) also presents AGB values as a result of two plot surveys conducted in Cambodia, which are 39 t/ha and 60 t/ha. Three other studies mentioned to Flooded forest AGB of Cambodia were found, and those values are 160, 170, and 175 t/ha, respectively (JICA Technical Assistants Team, 2015).

CCEAP (MoE/UNDP, 2003) also shows the result of two past studies in the region whose range is between 15 t/ha and 342 t/ha.

Since only limited field survey data are available for Flooded forest of Cambodia and the values vary among them, 70 t/ha in INC (MoE, 2002) and CCEAP (MoE/UNDP, 2003) is considered to be appropriate as AGB value for flooded forest until more reliable country specific data becomes available.

Fisheries Administration (FiA) of MAFF has implemented forest survey of flooded forest in Kampong Chhnang and Batambang in 2015 under the technical and financial assistance of FAO. Flooded forest AGB can be updated based on the result of this survey of FiA when it is available.

2.2.6 Forest regrowth

Forest regrowth AGB used in INC (MoE, 2002) and selected in CCEAP (MoE/UNDP, 2003) are 190 t/ha and 120 t/ha, respectively.

CCEAP (MoE/UNDP, 2003) also presents 41 t/ha and 53 t/ha estimated from two plot survey in Cambodia. On the other hand, 6 studies on forest regrowth AGB in Cambodia were found whose range is between 39 t/ha and 75 t/ha, although some caution is required for citing them because the definition for forest regrowth could be different among studies (JICA Technical Assistants Team, 2015).

The range of the regional AGB values for forest regrowth cited in CCEAP (2003) is 32 - 230 t/ha. The reason for the big differences among those figures is probably the large variance in the growing stage of this forest type.

Since all the country specific values mentioned above are smaller than that of INC (MoE, 2003) and CCEAP (MoE/UNDP, 2003) and there is no more material for justifying these figures, 75 ton/ha (CFI (2008) cited in Sar (2010)), which is the maximum value found in the past studies in Cambodia and could avoid possible overestimation, is recommended until more reliable data becomes available.

2.2.7 Pine plantation and Tree plantation

Plantation AGB used in INC (MoE, 2002) and selected in CCEAP (MoE/UNDP, 2003) are 80 and 100 t/ha, respectively.

Forest plantation species in Cambodia are mainly Pine, Acacia and Eucalyptus. However, country specific values of AGB in Cambodia for those plantations were not found, but some regional data are only available.

The range of acacia plantation AGB which are found in some literatures in various countries from Asia to South Pacific regions is between 56 t/ha and 245 t/ha (see Annex II). Eucalyptus plantation AGB found in some past studies in the same region also varies from 62 t/ha to 275 ton/ha (see Annex II). Pine plantation AGB value could not be found even in the region. CCEAP (MoE/UNDP, 2003) also shows the range of 60-153 t/ha as AGB cited from past studies of the region, however the planted species is not clear.

Plantation AGB must be largely influenced by the growing stage, or years after planting. However, it is difficult to collect the information on the age of each forest plantation from all over the country for the moment. Under these circumstances, it is appropriate to choose the value 100 t/ha for both Pine plantation ABG and Tree plantation AGB, which is selected in CCEAP (MoE/UNDP, 2003). This value is also provided in Good Practice Guidance for Land Use, Land-Use Change and Forestry (IPCC, 2003) as a default AGB value of forest plantation (other species) in "Moist with short dry season in Asia.

2.3 Rubber and oil palm plantation

Although rubber and oil palm plantations are not included in forest category under the forest definition for Cambodia' s REDD+, examining unit AGB for these plantations is useful when the simulation of actual biomass emission/removal including non-forest areas is required.

2.3.1 Rubber plantation

Two studies were found on Rubber plantation biomass in Cambodia, those are Khun et.al. (2008) and Toriyama et.al. (2011).

In Khun et.al. (2008), the volumes of stems (m3/ha) of rubber trees which were collected at 15 plots of 6 to 48 years old plantations are presented. 11 plots out of 15 are from 37 years old and older plantations. The values of stem volume were converted to the values of AGB by JICA Technical Assistants Team (JICA Technical Assistants Team, 2015). The range of values of AGB is 42 - 331 t/ha (the average is 218 t/ha).

The range of values in Toriyama et.al. (2011) is 0.9 – 81 t/ha (the average is 43 t/ha) which were collected at eight plots from 1 to 9 years old plantations. CCEAP (MoE/UNDP, 2003) also conducted two plot survey of rubber plantation in Cambodia and the estimated AGB is 88 and 113t/ha, respectively.

The values are also found in some studies in the region which vary from 8 to 191 t/ha (see Annex II)).

The values vary depending on the age class and probably on growing environment. Considering the available information on the values, the average biomass density estimated in Toriyama et.al., (2011), that is 43 t/ha, is recommended for Rubber plantation AGB for the moment. Although the age class of the plots in Toriyama et.al., (2011) tends to be young (up to 9 years old), this can fit to the situation of rubber plantation in Cambodia most of which are newly established.

2.3.2 Oil palm plantation

Country specific value for AGB of oil palm plantation has not been found. Then, Kotowska et al. (2015) conducted in Indonesia is referred. According to this study, average biomass of oil palm plantation is 42 t/ha (the figures of 2 sites are 37 t/ha and 47 t/ha respectively, each of which consists of 8 plots). Since this is the only figures found for the moment, this figure is suggested to be used for Oil palm AGB.

3 Summary of recommended unit AGB

In Table 5, the recommended values of AGB (t/ha) for each forest type in Cambodia are listed and compared with the other datasets of INC (MoE, 2002), CCEAP (MoE/UNDP, 2003) and other studies. Values in other studies were identified either by JICA Technical Assistants Team (2015), CCEAP (MoE, 2003) or in the literature review in this working paper.

As Table 5 shows, most of the recommended values are more or less at the midst of the ranges of the values in other studies, which might imply the recommended values are appropriately selected.

Table 5 Comparison of the AGB values (t/ha)

Land use/cover			INC	CCEAP	Range of values in other studies (Value is country specific)	Recommended AGB
Category		Sub-category				
Forest	Natural forest	Evergreen	295	200	96 - 380 (*1)	163
		Semi-evergreen	370	250	164 - 382 (*1)	243
		Deciduous	120	100	70 - 245 (*1)	85
		Pine forest	n.a.	n.a.	57, 102 (*2)	100
		Bamboo	n.a.	n.a.	45 - 242 (*3)	0
		Mangrove	175	150	89, 198 (*2) 92 - 299 (*1)	150
		Rear mangrove	n.a.	n.a.	48 - 235 (*3)	165
		Flooded forest	70	70	160, 170, 175 (*1) 39, 60 (*2) 15 - 342 (*2)	70
		Forest regrowth	190	120	39 - 75 (*1) 41, 53 (*2) 32 - 230 (*2)	75
		Pine plantation	80	100	n.a.	100
		Other plantation	80	100	56 - 245 (Acacia,*3) 62 - 275 (Eucalyptus,*3) 60 - 153 (*2)	100
Cropland		Rubber	n.a.	n.a.	0.9 - 81 (*1) 42—331 (*1) 88, 113 (*2) 8 - 191 (*3)	43
		Oil palm	n.a.	n.a.	37, 47 (*3)	42

References* 1: JICA TA Team (2015), 2: MoE/UNDP (2003), 3: Annex II of this Working Paper #14.

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別添資料 5

国家 REDD+戦略　2017 年 5 月版の非公式英訳版

The Kingdom of Cambodia

Nation Religion King

Royal Government of Cambodia

National REDD+ Strategy 2017-2026

May 2017

Samdech Akka Moha Sena Padei Techo HUN SEN
Prime Minister of the Kingdom of Cambodia

Message

Cambodia has ratified The Paris Agreement of the United Nations Framework Convention on Climate Change and has joined the international community to address the challenge of global climate change. The national policies of the Royal Government that include the Rectangular Strategy Phase III and the National Strategic Development Plan, prioritize action on climate change.

The Royal Government of Cambodia considers REDD+ an effective global initiative that will contribute to mitigating impacts of climate change in agriculture, forestry and related sectors. Cambodia REDD+ provides an opportunity to support the Ministry of Agriculture, Forestry and Fisheries, the Ministry of Environment, and relevant stakeholders, including local communities and indigenous peoples in their efforts to sustainably manage forest resources in the country.

The vision of Cambodia's National REDD+ Strategy is to contribute to national and global climate change mitigation by improving the management of its natural resources and forest lands.

Therefore, on behalf of the Royal Government of Cambodia, I am pleased to announce the promulgation of the Cambodia National REDD+ Strategy 2017-2026. This strategy is an expression of our continued commitment to sustainable forest resource management in an era of climate change.

Finally, successful implementation of the Strategy will depend on effective collaboration and participation from the Government, private sector, national and international non-governmental organizations, development partners and local communities. I invite all stakeholders to strengthen cooperation with relevant Government agencies, particularly Ministry of Agriculture, Forestry and Fisheries and Ministry of Environment to successfully implement the National REDD+ Strategy in order to contribute to the Royal Government's commitment to move Cambodia's society towards green economy development, low carbon pathway and climate resilient Cambodia.

Phnom Penh, ……. 2017

HUN SEN

Preface

On behalf of the Ministry of Agriculture, Forestry and Fisheries, I would like to express my profound respect and sincere gratitude to **Samdech Akka Moha Sena Padei Techo HUN SEN**, Prime Minister of the Kingdom of Cambodia. My Ministry honours the Prime Minister's support and commitment to addressing climate change issues in Cambodia, and his active engagement with the international community in responding to climate change challenges through reducing deforestation and forest degradation.

The impacts of climate change and the consequences of deforestation and forest degradation pose major challenges to Cambodia's key development sectors, including agriculture, forestry and fisheries, biodiversity and environmental management. Responding to this, the Ministry of Agriculture, Forestry and Fisheries has coordinated the development of the Cambodia National REDD+ Strategy that provides a framework and action plan to reduce deforestation, and forest degradation in Cambodia.

The mission of the REDD+ Strategy is to strengthen the capacity of national and sub national institutions for effective implementation of policies, laws and regulations that will contribute to improved management of natural resources, forest lands, and biodiversity conservation. The goal of the strategy is to reduce deforestation and forest degradation, promote sustainable management and conservation, and contribute to poverty alleviation of local communities. The National REDD+ Strategy also provides guidance for implementation of actions that will enhance forest productivity, increase supply of forest and non-forest products, and contribute to conservation and protection of forest ecological systems.

This Strategy has been developed with the collaboration, commitment and effort of key stakeholders, including local communities, indigenous peoples, national and sub-national government institutions, and with support from national and international non-governmental organizations and development partners.

On behalf of the Ministry of Agriculture, Forestry and Fisheries, I would like to acknowledge the contribution of all stakeholders, for their support in developing this Strategy in an effective and timely manner, and look forward to continued cooperation in its implementation.

Phnom Penh,……..2017
Minister
Ministry of Agriculture, Forestry and Fisheries

Veng Sakhon

Preface

On behalf of the Ministry of Environment, I would like to express my profound respect and sincere gratitude to **Samdech Akka Moha Sena Padei Techo HUN SEN**, Prime Minister of the Kingdom of Cambodia. My Ministry honours the Prime Minister's support and commitment to addressing climate change issues in Cambodia, and his active engagement with the international community in responding to climate change challenges through reducing deforestation and forest degradation.

The Royal Government of Cambodia has taken significant policy measures that aim to address deforestation and forest degradation. These include the consolidation of Cambodia's protected areas under the Ministry of Environment and the establishment of biodiversity conservation corridors. The Ministry has also drafted an Environment and Natural Resources Code that aims to establish principles for the sustainable and equitable management of Cambodia's rich endowment of forest and biodiversity resources.

The protected area system of Cambodia cover about 41 per cent of the country's total area that is one of the highest percentages of national territory within protected areas in the world. In order to improve the management of protected areas the Ministry of Environment has prepared a National Protected Area Strategic Management Plan (NPASMP) that will complement the promulgation of the National REDD+ Strategy. Effective implementation of the NPASMP and the NRS will together contribute to reducing deforestation and forest degradation in Cambodia.

The mission of the REDD+ Strategy is to strengthen the capacity of national and sub national institutions for effective implementation of policies, laws and regulations that will contribute to improved management of natural resources, forest lands, and biodiversity conservation. This Strategy has been developed with the collaboration, commitment and effort of key stakeholders, including local communities, indigenous peoples, national and sub-national government institutions, and with support from national and international non-governmental organizations and development partners.

On behalf of the Ministry of Environment, I would like to acknowledge the contribution of all stakeholders, for their support in developing the National REDD+ Strategy in an effective and timely manner, and look forward to continued cooperation in its implementation.

Phnom Penh,……...2017
Minister
Ministry of Environment

Say Samal

Acknowledgements

The Royal Government of Cambodia expresses its gratitude to national ministries and agencies, development partners, international and national non-governmental organizations, the private sector, academia and all stakeholders for their contribution to the development of the Cambodia National REDD+ Strategy.

The Strategy was developed under the overall coordination of the Ministry of Agriculture, Forestry and Fisheries with the active participation of the Ministry of Environment. The Cambodia REDD+ Taskforce, technical teams, consultation group and gender group participated actively and provided invaluable guidance to the development of the REDD+ Strategy. Stakeholders at the local, sub-national and national level provided important inputs in developing the Strategy. National and international experts were generous in providing technical support to the document.

The development of the REDD+ Strategy was made possible with financial support from development partners, namely the United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (UN-REDD Programme); Food and Agriculture Organization (FAO); Japan International Cooperation Agency (JICA); and the World Bank's Forest Carbon Partnership Facility (FCPF).

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Abbreviations

BUR	Biennial Update Report
COP	Conference of the Parties
ELCs	Economic Land Concessions
ENRC	Environment and Natural Resources Code
FA	Forestry Administration
FAO	Food and Agriculture Organization
FCPF	Forest Carbon Partnership Facility
FiA	Fisheries Administration
FRL	Forest Reference Level
GDANCP	General Department of Administration for Nature Conservation and Protection
GHG	Greenhouse Gas
GRM	Grievance Redress Mechanism
IPCC	Intergovernmental Panel on Climate Change
JICA	Japan International Cooperation Agency
MAFF	Ministry of Agriculture, Forestry and Fisheries
MEF	Ministry of Economy and Finance
MME	Ministry of Mines and Energy
MoE	Ministry of Environment
MoI	Ministry of Interior
MLMUPC	Ministry of Land Management, Urban Planning and Construction
MOWA	Ministry of Women's Affairs
MRD	Ministry of Rural Development
MRV	Measurement, Reporting and Verification
M&E	Monitoring and Evaluation
NCSD	National Council for Sustainable Development
NFDF	National Forestry Development Fund
NFI	National Forest Inventory
NFMS	National Forest Monitoring System
NFP	National Forest Programme
NGO	Non-Governmental Organization
NPASMP	National Protected Areas Strategic Management Plan
NRS	National REDD+ Strategy
NSDP	National Strategic Development Plan
REDD+	Reducing Emissions from Deforestation and forest Degradation, conservation of forest carbon stocks, sustainable management of forests, and enhancement of forest carbon stocks
RGC	Royal Government of Cambodia
RTF	REDD+ Taskforce
RTS	REDD+ Taskforce Secretariat
SIS	Safeguards Information System
SLC	Social Land Concession
SLMS	Satellite Land Monitoring System
SPFF	Strategic Planning Framework for Fisheries
LULUCF	Land Use, Land Use Change and Forestry
UNFCCC	United Nations Framework Convention on Climate Change
tCO_2	Tonnes of carbon dioxide

Executive Summary

The Royal Government of Cambodia (RGC) provides strong support to the development and implementation of REDD+ as an option to mitigate impacts of climate change, and reduce greenhouse gas emissions from the forestry sector. The outcomes of effective implementation of REDD+ policies and measures would contribute to socio-economic development and promote the shift towards sustainable development. Cambodia has incorporated REDD+ into several of its key climate change development policies, strategies and programmes.

Cambodia's REDD+ programme is consistent with decisions adopted by the United Nations Framework Convention on Climate Change (UNFCCC) that recommends three phases of readiness, implementation, and results based payments for greenhouse gas (GHG) emission reductions from the forestry and land use sector. Cambodia initiated its REDD+ readiness in 2012 and has made significant progress in meeting UNFCCC requirements related to achievement of key milestones for readiness. The National REDD+ Strategy (NRS) has been developed; a Forest Reference Level (FRL) completed and submitted to the UNFCCC in late 2016; the design of a National Forest Monitoring System (NFMS) has been completed; and significant policy analysis and consultation undertaken to design and establish a Safeguards Information System (SIS).

VISION: The vision of Cambodia's National REDD+ Strategy is to contribute to national and global climate change mitigation through improving the management of its natural resources and forest lands, and biodiversity conservation and sustainable development.

MISSION: The mission of the Strategy is to strengthen the functioning and capacity of national and sub-national institutions for effective implementation of policies, laws and regulations to enhance management of natural resources and forest lands, and biodiversity conservation.

GOAL: The goal is to reduce deforestation and forest degradation while promoting sustainable management, conservation of natural resources and contribute to poverty alleviation.

The scope of Cambodia's REDD+ Strategy will prioritize addressing deforestation, and build capacity alongside to later address forest degradation. Cambodia will implement REDD+ at the national level under the results-based payment mechanism of the UNFCCC. Cambodia will consider implementation of sub- national and voluntary market based REDD+ projects subject to specific criteria.

The three strategic objectives that have been identified to achieve the vision, mission and goal

of the Strategy are to: (1) Improve management and monitoring of forest resources and forest land use; (2) Strengthen implementation of sustainable forest management; and (3) Mainstream approaches to reduce deforestation, build capacity, and engage stakeholders.

The National REDD+ Strategy will be implemented in two phases:

Phase I 2017-2021 An action plan will be developed and institutional arrangements for the implementation of the NRS will be finalized. Drivers will be addressed through improved implementation of existing forest management frameworks such as the NFP, NPASMP, SPFF and sub-decrees on ELCS and SLCs. These frameworks include policies and measures related to strengthening forest law enforcement, providing tenure security and implementing community based nature resource management. Implementation is however hindered by adequate financial and technical resources. The NRS will prioritize mobilisation of upfront non-results based finance that will address these challenges and alongside build capacity for field based implementation and results. Steps will be taken to improve existing versions of the FRL and the NFMS and a SIS will be established to complete the requirements of the Warsaw Framework. A mid-term assessment of the NRS will be undertaken to identify lessons, challenges, and to address these during the next phase.

Phase II 2022-2026 The NRS focus during this phase will be to complete the transition from readiness to implementation and prioritize the achievement of measurable results. The findings of the assessment of Phase I would be reviewed and appropriate steps would be taken. An assessment would also be made of the forest and land cover change results of 2016, 2018, and 2020 that would provide an indication of the effectiveness of the NRS. A key milestone during this phase would be the establishment of a rigorous forest monitoring mechanism that can review policies and measures to address drivers of deforestation and forest degradation for effectiveness and efficiency. In addition the SIS will continue to monitored and strengthened as required to ensure compliance with UNFCCC requirements for safeguards. This phase will also establish a functioning disclosure mechanism of the information, data, and results of FRL, NFMS, studies and analytical work through a web-based platform and other communication media and tools. This phase will also see improved and accurate data and results that will lead to revised versions of the FRL and the NFMS.Cambodia will submit its first report on emission reductions for results-based payments during this phase.

The Cambodia National REDD+ Strategy provides a roadmap for the implementation of policies and measures to address the drivers of deforestation and forest degradation. Successful

implementation of the NRS will depend on the transformative actions related to the management and governance of natural resources and forest lands in Cambodia. This will further depend on the strengthening of institutions, regulations, mechanisms and inter-ministerial coordination.

To achieve these transformative actions adequate and appropriate capacity will need to be created; procedures and regulations would need to become efficient and transparent; and national mechanisms and inter-ministerial coordination would need better integration.

The NRS will create awareness and strengthen engagement of stakeholders and the public to participate actively in effective implementation of policies and regulations that will lead to improved management of natural resources, forest lands, biodiversity conservation, and sustainable development. This will make a significant contribution to Cambodia's shift towards low carbon pathways and a green economy, and contribute to national and global climate mitigation that will help realise the vision of Cambodia's REDD+ Strategy.

1. INTRODUCTION

The Royal Government of Cambodia is committed to reducing greenhouse gas emissions to contribute to global efforts on climate change. Cambodia with its high forest cover in Southeast Asia has long recognized that deforestation and forest degradation are significant sources of emissions. As an active Party to the UNFCCC Cambodia has provided consistent support to decisions and actions related to climate change mitigation, through improving the sustainable management of its natural resources, forest land and biodiversity conservation.

In 2007, at the UNFCCC Conference of the Parties (COP) in Bali, Cambodia provided strong support to the adoption of REDD+, a global policy initiative to reduce emissions from deforestation and forest degradation; and the role of sustainable management of forests, conservation and enhancement of forest carbon stocks in developing countries.

In 2008, two REDD+ pilot projects were established in Cambodia, and in 2010, the national REDD+ roadmap was finalised for implementation. Cambodia's REDD+ Readiness started in 2012 with the establishment of the Cambodia National REDD+ Programme and institutional arrangements that include an inter-ministerial national REDD+ taskforce and a secretariat. Stakeholder engagement, capacity building and awareness raising have remained strong elements of REDD+ in Cambodia.

1.1 REDD+ at the International Level

Since 2005, Parties to the UNFCCC have been actively negotiating a policy initiative for the development and implementation of policies and measures that would contribute to climate change mitigation through REDD+. Under the Cancun Agreement of the UNFCCC, developing countries are encouraged to contribute to climate change mitigation actions in the forestry sector by undertaking REDD+ activities.

The UNFCCC also established the process, rules and modalities for developing countries to access **results based payments** for REDD+ activities. The Warsaw Framework for REDD+ recalls that developing countries are eligible to receive **results-based payments** for actions that are fully measured, reported and verified. The Cancun Agreement and the Warsaw Framework state that before receiving such payments, developing countries are required to establish an institutional framework as presented in Figure 1.

Figure 1: Warsaw Framework for REDD+

The Warsaw Agreement also provides guidance on reporting requirements that have to be met prior to receiving results-based payments. These include submission of a FRL for technical assessment to the UNFCCC and the establishment of a NFMS. These steps are designed to ensure measurement, reporting, and verification of anthropogenic forest-related emissions by sources and removals by sinks, forest carbon stocks, and forest-area changes resulting from the implementation of REDD+ policies and measures. Mitigation results are to be reported through a technical annexure to the Biennial Update Report (BUR) that will be done through submission of the national GHG inventory. In addition, countries are required to submit a summary of information on how REDD+ safeguards have been addressed and respected.

1.2 Cambodia REDD+ Readiness 2008-2016

Cambodia announced at the 2007 UNFCCC COP in Bali, Indonesia that, "*The Royal Government of Cambodia strongly supports the inclusion of GHG emission reduction from forest conservation and avoided deforestation in post-Kyoto regimes*".

Cambodia began to plan its REDD+ readiness process from 2008 onwards. During 2008-2016, the Cambodia REDD+ Programme achieved important milestones and learned important lessons, including the understanding that REDD+ must be mainstreamed within existing and planned national government policies, frameworks and plans related to sustainable

development, resilient agriculture, conservation and low carbon development pathways.

The RGC has taken significant measures to address climate change in the context of sustainable development, and to improve national coordination mechanisms that will have positive impacts on the sustainable management of forest resources. A Climate Change Strategic Plan (2014-2023) has been approved and is mainstreaming climate change into national and sub-national planning processes. The **National Council for Sustainable Development** (NCSD) has been established to promote sustainable development by ensuring a balance between economic, social, environmental, and cultural development in Cambodia. The Government recognizes that the sustainable management of forest resources will make an important contribution to local livelihoods, generate co-benefits and build resilience against extreme climate-change-induced events.

REDD+ has been recognized by the RGC as one of the means for Cambodia to contribute to addressing global climate change, and to fulfil its commitments under the UNFCCC. REDD+ has been acknowledged as one of the mechanisms to generate financial support for Cambodia to develop and strengthen implementation of its policies and measures related to sustainable forest management and poverty alleviation.

1.3 National REDD+ Strategy 2017-2026

The National REDD+ Strategy for the period 2017-2026 takes note of the Cancun Agreement, the Warsaw Framework for REDD+, the Paris Agreement and RGC policies. Cambodia has developed and submitted its FRL to the UNFCCC; developed its national forest monitoring system; and undertaken significant analytical and awareness work on establishing a safeguards information system that will include a grievance mechanism. The institutional framework for REDD+ will enable Cambodia to report its GHG emissions from the land use, land use change, and forestry (LULUCF) sector and provide a technical annex to the BUR to be submitted to the UNFCCC as part of the process to request **results based payments**.

The preparation of the National REDD+ Strategy followed an inclusive consultation process. A consultation roadmap was prepared and multiple national and sub-national consultations were held to ensure all key stakeholders from local communities, women, forest users, civil society organizations, sub-national government administration, and relevant national government ministries were given adequate opportunities to provide comments and contribute inputs to the strategy. The consultation group that represents nine constituencies and is an

intrinsic part of Cambodia's REDD+ institutional framework was actively engaged with the consultation process. In addition a gender group was established to provide comments and inputs to the strategy.

The strategy articulates a vision, mission and goal; identifies deforestation trends and causes; and proposes a set of strategic objectives and actions. With effective inter-ministerial coordination, and adequate technical, human and financial resources Cambodia is well positioned to transition from readiness to implementation of its national REDD+ strategy.

2. STRATEGIC FRAMEWORK

Cambodia's National REDD+ Strategy 2017-2026 strategic framework builds on the strategic analysis and identifies strategies and actions to address drivers of deforestation and forest degradation.

2.1 Vision

The vision of Cambodia's National REDD+ Strategy is to contribute to national and global climate change mitigation through improving the management of its natural resources and forest lands, and biodiversity conservation and sustainable development.

2.2 Mission

The mission of the Strategy is to strengthen the functioning and capacity of national and sub-national institutions for effective implementation of policies, laws and regulations to enhance management of natural resources and forest lands, and biodiversity conservation.

2.3 Goal

The goal is to reduce deforestation and forest degradation while promoting sustainable management, conservation of natural resources and contribute to poverty alleviation.

2.4 Scope and Scale

The scope of the NRS prioritizes deforestation measured through land use change and conversion of forest land, and will build capacity alongside to address degradation. Cambodia will implement REDD+ at the national level under the results-based payments mechanism of the UNFCCC. Cambodia will consider implementation of sub- national and voluntary market based REDD+ projects subject to specific criteria.

2.5 Milestones and Results

The Cambodia REDD+ strategy aims to achieve a key milestone by 2026.The objective is to reduce its annual deforestation by half compared to the rate during the FRL period of 2006-2014. Reduced emissions would be eligible for results based payments.

The target will be achieved by implementing the REDD+ strategy through two phases. The first phase over 2017-2021 will finalize an action plan, consolidate the readiness process,

finalize the institutional framework, and mobilize non-results based investments as upfront finance for implementation. The second phase over 2022-2026 will operationalize a results-based mechanism with a measured, reported and verifiable target of GHG emissions by 2026.

2.6 Guiding Principles

The REDD+ strategy will be guided by the following principles:

- Fulfil Cambodia's contribution to the achievement of the Objectives, as set out in Article 2, and Commitments, as set out in Article 4, Paragraph 3, of the UNFCCC
- Build on the RGC's existing coordination mechanisms and support the implementation of national policies, laws and regulations related to climate change and sustainable development
- Promote cross-sectoral engagement and coordination for the implementation of REDD+ policies and measures
- Ensure full and effective participation of relevant stakeholders, including those most vulnerable, such as local communities, indigenous peoples and women
- Build capacity within government institutions and non-government stakeholders
- Maintain consistency with methodologies and guidance as set out by the Intergovernmental Panel on Climate Change (IPCC).

3. STRATEGIC ANALYSIS

The strategic analysis provides an overview of the national policy framework and the evolving role of forest resources; an overview of forestry sector institutions and challenges; the current status of forest cover change and its causes; and potential carbon credit and benefits of reducing emissions in Cambodia's forests.

3.1 Alignment with National Development Goals and Priorities

The Cambodia REDD+ Readiness Roadmap and achievements from activities conducted during the implementation of the Roadmap were the basis for developing the NRS. The Roadmap was a product of extensive consultations with multiple diverse stakeholders from the local to international level. While contributing to current national forest management strategies and programmes, the NRS is linked to current policies, strategic plans, socio-economic development programmes and the environment.

The NRS supports and complements the implementation of Cambodia's broader development plans in particular, the development of the NRS has taken into account the following national policies, strategies and programmes:

- Rectangular Strategy Phase III 2013-2018
- National Strategic Development Plan 2014-2018
- National Policy on Green Growth and Green Growth Strategic Plan 2013-2030
- Cambodia Climate Change Strategic Plan 2014-2023
- National Protected Areas Strategic Management Plan 2016-2030
- National Biodiversity Strategy and Action Plan 2016-2020
- Strategic Planning Framework for Fisheries 2010-2019
- National Forest Programme 2009-2029
- Gender and Climate Change Action Plan 2014-2018
- Cambodia's First 2002, and Second 2015 National Communication to the UNFCCC.

The Royal Government of Cambodia has taken several transformative steps and made the sustainable management of natural resources, including its forest resources, its primary policy priority. The Rectangular Strategy Phase III and the National Strategic Development Plan (NSDP) 2014-2018 reinforce as well as broaden the management of the country's natural resources to achieve an optimal "balance between development and conservation". That

balance is intended to enhance the contributions of natural resources to the Cambodia's development by ensuring the conservation of the country's forests and wildlife, sustaining its fisheries resources, and maintaining the integrity of its forest ecosystems.

At the institutional level the RGC has completed the reorganization of its Ministry of Environment (MoE) and has established the National Council for Sustainable Development chaired by the Prime Minister to coordinate and integrate sustainable development principles. The RGC has also taken a decision to integrate Cambodia's national REDD+ institutional arrangements with the NCSD and the MoE. This will enable mainstreaming of approaches and measures that will strengthen sustainable management of natural resources and forest lands. The MoE is also developing an Environment and Natural Resources Code (ENRC) to review its existing environmental laws with the objective of rationalizing the legal framework. The ENRC will strengthen the policy framework and lead to improved management of social and environmental impact assessment regulations. During 2016 significant policy measures have been finalized. These include the consolidation of conservation areas in the MoE and declaration of additional conservation areas. MoE now manages a protected area network of 49 landscapes and biodiversity conservation corridors that cover an area of approximately 7.5 million hectares that is almost 41 percent of Cambodia's land area. A National Protected Area Strategic Management Plan 2016-2030 has been prepared with implementation to begin in 2017.

3.2 Overview of Forest Land Management in Cambodia

Cambodia's 9 million ha of forests are managed under the jurisdiction of the MoE and the Ministry of Agriculture, Forestry and Fisheries (MAFF). The Forestry Administration (FA) within MAFF is responsible for the management of the permanent forest estate that includes forest reserves, and conversion forests. The Fisheries Administration (FiA) in MAFF is responsible for the management of the country's flooded forests and mangrove areas. The General Department of Administration for Nature Conservation and Protection (GDANCP), MoE is responsible for management of approximately 7.5 million ha protected areas network of Cambodia that includes the core areas of the Tonle Sap Biosphere Reserve and biodiversity conservation corridors.

The forestry sector policy framework is guided by the National Protected Area Strategic Management Plan 2016-2030; the National Forest Programme 2010-2029; and the Strategic Planning Framework for Fisheries 2010-2019.

The NPASMP is designed around four strategic objectives that aim to strengthen conservation, enhance sustainable management, expand community livelihood opportunities, and strengthen infrastructure and institutional capacity. The MoE, that is also the country's focal point for the UNFCCC, is responsible for implementing the Climate Change Strategic Plan 2014-2023, promoting green growth, and low emissions development approaches.

The NFP consists of six programmes that includes forest demarcation, classification and registration; conservation and development of forest resources and biodiversity; forest law enforcement and governance; community forestry; capacity and research development; and sustainable forest financing. Current national policy commitments under the NFP include increasing the country's forest cover to 60 per cent. One of the principal aims of the NFP is to support the establishment of community forests through the allocation of increased forestland to rural communities. Under the Forest Law, rights of local communities and the importance of decentralized management of natural resources are well recognized.

The principal challenges for forestry sector institutions are capacity constraints for management of forest resources, land use planning, forest resource assessment and forest monitoring. In addition law enforcement capacity and implementation requires strengthening. Forestry staff also need new skills and methodologies to apply innovative approaches for land and forest resource management, enhance community based natural resource management, green value chains, and contribute to rural livelihoods. Capacity constraints are especially important at the sub national level to strengthen field operations for forest management and law enforcement. The NFP, NPASMP, and SPFF will provide impetus to address these challenges and will also be able to absorb additional funds to effectively operationalize its programmes and objectives.

3.3 Forest Cover Change

Cambodia's forest cover has undergone significant change first, in earlier years as the result of civil war and social dislocations, and, more recently as a result of the evolving role of forest resources with respect to the country's development priorities, levels of poverty and dependence on forest resources. During the period 1965-2014 Cambodia's forest cover has declined from 73.04 per cent to 49.48 per cent as illustrated by Figure 2.

Forest cover assessment data used for the Cambodia FRL covers the eight year period 2006-2014 and excludes rubber and palm oil plantations. As per the national definition forest cover

in 2006 was 59.09 per cent and in 2010 it was 57.07 per cent, and in 2014 it was 49.48 per cent. In 2006 and 2010 there were no rubber or palm oil plantations and the period 2010-2014 forest cover change to 46.90 per cent has been due to agro-industrial plantations of mainly rubber and palm oil, and grant of social land concessions.

Figure 2: Forest cover change in Cambodia 1965-2014

3.4 Drivers of Deforestation and Forest Degradation in Cambodia

Drivers of deforestation and forest degradation are unique to Cambodia's national circumstances, capacities and capabilities. Deforestation and forest degradation result from a complex set of processes. Historically in Cambodia these include:

- Improvements in accessibility to remote forested areas, commercial logging, and infrastructure projects; and inadequate government capacity to manage forests in these areas
- Uncertain land tenure, land speculation, unauthorised encroachment of forest lands
- Rapid expansion of agriculture into forest lands, grant of large scale agro industrial

economic land concessions, and distribution of land titles under social land concessions between 1996-2006

- Unauthorized logging and unsustainable harvesting of forest and non-timber products
- Weak forest governance, law enforcement, and monitoring of forest and land use sector
- Increasing regional and global demand for raw materials such as rubber and sugar
- Population increase and demand for agricultural land
- Rural poverty and lack of alternative livelihoods.

Other drivers include migration into forest areas, weak implementation of land laws, inadequate implementation of environmental and social impact assessment regulations, and a lack of state land registration and forest estate demarcation.

By 2014, the RGC granted total forest land area of approximately 2.02 million hectares for agribusiness development of which 1.55 million hectares was granted under the jurisdictional management of MAFF and 470,000 hectares under the jurisdictional management of MoE. In addition, forest land area was granted in the form of concessions for natural gas and mining exploration. During the period 2009 to 2013, a total forest area of 2.45 million hectares was allocated as social land concessions to poor households, military households and for establishing new villages. In 2014, the government de-gazetted forest land area of 1.2 million hectares to issue land titles to landless communities. Development of infrastructure also contributes to forest cover change.

3.5 Potential for Emissions Reduction and Co-benefits in Cambodia

Assessments in Cambodia indicate that from 2006 to 2010, annual GHG emissions from deforestation account for 34,148,629 tCO_2, while from 2010 to 2014 they account for 151,267,528 tCO_2, a four-fold increase. Cambodia's remaining forested area serves as a carbon sink. Cambodia's forest-removed GHG accounts for an annual average of -6,626,046 tCO_2 from 2006 to 2010 and -20,298,825 tCO_2 from 2010 to 2014. Therefore, the total GHG sources resulting from deforestation and removal by sink is 158,491, 286 tCO_2. This is an annual average of 79,245,643 tCO_2.

Despite its deforestation rate, Cambodia has high potential to reduce emissions from deforestation and forest degradation, and enhance forest carbon stocks. Assessments based on the 2014 forest cover map indicate that a total of 2.41 Gt of carbon dioxide are stored in the country's forests, down from the 2.93 Gt of carbon dioxide in 2006.

Period tCO_2 Per Year	2006-2010	2010-2014
Annual CO_2 Removals	-6,626,046	-20,298,825
Average Annual CO_2 Removals	-13,462,436	
Annual CO_2 Emissions	34,148,629	151,267,528
Average Annual CO_2 Emission	92,708,079	
Net Total Annual CO_2 Emissions and Removals	27,522,583	130,968,703
Average Net Total Annual CO_2 Emissions and Removals	79,245,643	

Table 1: Emissions and removals 2006-2014

The largest areas of very high carbon density are found in the wet evergreen forests of the Cardamom Mountains Rainforest Eco region in the southwest of the country. The highest carbon density class that holds 20 percent of the country's carbon covers 12 percent of the country's land area; approximately 40 percent of Cambodia's carbon stock is held in less than 23 percent of its area.

Deforestation and forest degradation accounts for around 17 percent of global GHG emissions. In Cambodia, however, loss of forest cover and associated land use change are the main factors for the country becoming a net emitter of GHGs. Forests serve as the single most important sink of GHGs in Cambodia. According to the MoE's GHG inventory, while Cambodia emitted a total of 47,000 Gg of GHG for the year 2000, its forest cover helped absorb more than half that amount – 24,500 Gg. Degradation of forest and loss of cover means the potential for absorbing GHGs will also be compromised.

Scientific predictions of climate change for Cambodia suggest that forests will be affected by changes in temperature, precipitation and shifts in seasons. The Second National Communication 2015 to the UNFCCC by MoE indicated that exposing forests to a longer dry period might reduce forest productivity and increase the risk of fire. If forests are being logged, there is a risk that it will take longer for them to regenerate. The impacts of climate change could have multiple consequences. Given the importance of forests to rural livelihoods, any loss of productive forests, as well as of biodiversity, will lead to loss of income or livelihood options for forest-dependent and adjacent communities. Exposing forests to longer dry periods might reduce forest productivity and biodiversity. This could also lead to atypical insect growth cycles that can further affect agriculture and forests. The integrity of forest cover is linked to

maintenance of fresh water supply and soil cover and quality, and this link could be negatively affected. The loss of forests may lead to consequences such as storms, soil erosion and landslides.

Nearly four million people live within five kilometres of a forest, with forest resources accounting for an average of 10 percent to 20 percent of household consumption. The vast majority of rural households – about 84 percent – rely on fuel wood and charcoal. Traditionally, forest resources – in particular, non-timber forest products – have provided important safety nets for rural people in times of crisis.

Much of Cambodia's terrestrial carbon stock occurs in areas that have the potential to generate co-benefits and are also important for biodiversity conservation. Many of these areas also have some form of protection status. Actions to secure more of these areas and their carbon, as well as to improve management, are likely to achieve substantial biodiversity-related co-benefits.

Cambodia is a country with high potential to reduce GHG emissions from deforestation and forest degradation and expand the area that can absorb carbon. Protecting forests, and thereby watersheds and land, can contribute to ecological protection, water resource management, sustainable land use and agriculture, and human health. Conservation of biodiversity and enhancement of other environmental services are additional co-benefits.

The rich forest resources of Cambodia play critical roles in rural livelihoods as well as providing valuable ecological and economic resources for the country's overall development. Managing forests sustainably and equitably will be essential for maintaining ecological integrity, maintaining freshwater supplies and protecting biodiversity. It is through forest management that much of the potential new climate change finance could be realized with significant potential benefits for economic, social, environmental and cultural development in Cambodia.

4. STRATEGIC OBJECTIVES

4.1 Strategic Objective 1: Improve management and monitoring of forest resources and forest land use

Strategies

- Strengthen management of forest conservation areas, such as protected areas and flooded and mangrove conservation areas
- Promote forest land tenure security through forest land classification, zoning, demarcation, and registration
- Strengthen law enforcement activities to address unauthorized logging, and encroachment
- Monitor the status of ELCs and SLCs for compliance with regulations
- Support harmonization of legal frameworks for effective management of forest resources
- Strengthen regulatory framework and capacity for social and environmental impact assessment and compliance
- Strengthen capacity for data management and establish decision support systems for forest and land use sector

4.2 Strategic Objective 2: Strengthen implementation of sustainable forest management

Strategies

- Strengthen and scale up community-based forest management
- Engage and encourage the private sector to implement alternative and sustainable supply chains from agro industrial plantations, and to reduce emissions
- Expand afforestation, reforestation and restoration activities
- Enhance timber supply and wood-based energy sourced from community-based forest management areas and private plantations to reduce pressure on forest areas
- Promote effective, equitable, sustainable management and use of forests, forest lands and non-timber forest products
- Identify and implement alternative and sustainable livelihood development programmes for local communities most dependent on forest resources

4.3 Strategic Objective 3: Mainstream approaches to reduce deforestation, build capacity and engage stakeholders

Strategies

- Support mechanisms to mainstream policies and measures that reduce deforestation in relevant government ministries and agencies
- Strengthen national and sub national capacity for improved coordination mechanisms for national land use policy and planning
- Strengthen capacity, knowledge and awareness of stakeholders to enhance their contribution to reducing deforestation and forest degradation
- Encourage public engagement, participation and consultations in forestry and land use planning, and promote the involvement of multiple stakeholders
- Strengthen capacity of academic and research institutions in training, research and technology development associated with forestry and land use
- Establish partnerships with development partners in building knowledge and human resources related to forestry, land use and climate change.

5. IMPLEMENTATION APPROACH

The NRS provides a strategic framework for the ten year period 2017-2026 during which Cambodia REDD+ will consolidate and complete its readiness, develop the institutional framework, access adequate finance, and implement measures that will reduce emissions and make Cambodia eligible for results-based payments. The implementation approach has been divided into two five-year phases that will ensure planned actions are completed effectively and efficiently.

5.1 Phase I 2017-2021

An action plan will be developed and institutional arrangements for the implementation of the NRS will be finalized. Drivers will be addressed through improved implementation of existing forest management frameworks such as the NFP, NPASMP, SPFF and sub-decrees on ELCS and SLCs. These frameworks include policies and measures related to strengthening forest law enforcement, providing tenure security and implementing community based nature resource management. Implementation is however hindered by adequate financial and technical resources. The NRS will prioritize mobilisation of upfront non-results based finance that will address these challenges and alongside build capacity for field based implementation and results. Steps will be taken to improve existing versions of the FRL and the NFMS and a SIS will be established to complete the requirements of the Warsaw Framework. A mid-term assessment of the NRS will be undertaken to identify lessons, challenges, and to address these during the next phase.

5.2 Phase II 2022-2026

The NRS focus during this phase will be to complete the transition from readiness to implementation and prioritize the achievement of measurable results. The findings of the assessment of Phase I would be reviewed and appropriate steps would be taken. An assessment would also be made of the forest and land cover change results of 2016, 2018, and 2020 that would provide an indication of the effectiveness of the NRS. A key milestone during this phase would be the establishment of a rigorous forest monitoring mechanism that can review policies and measures to address drivers of deforestation and forest degradation for effectiveness and efficiency. In addition the SIS will continue to monitored and strengthened as required to ensure compliance with UNFCCC requirements for safeguards. This phase will also establish a functioning disclosure mechanism of the information, data, and results of FRL, NFMS,

studies and analytical work through a web-based platform and other communication media and tools. This phase will also see improved and accurate data and results that will lead to revised versions of the FRL and the NFMS. Cambodia will submit its first report on emission reductions for results-based payments during this phase.

5.3 Development of Warsaw Framework

To be eligible to request results-based finance for reduced emissions Cambodia is required to develop elements under the Warsaw Framework that include a FRL, NFMS, and SIS. Cambodia REDD+ readiness is in an advanced stage of developing this institutional framework and will continue to further strengthen the framework during the implementation of the NRS.

5.3.1 Forest Reference Level

Cambodia's FRL is a benchmark that will be used to assess the country's performance in implementing REDD+ policies in verifiable results for receiving payments for emission reductions.

Cambodia has finalized and submitted its FRL and a team of the UNFCCC REDD+ technical experts has already completed the technical assessment in 2017. The priority for Phase I is to address the findings of the UNFCCC technical assessment and to revise and improve the FRL. This phase will also see accuracy assessment of forest cover/land use changes that will contribute to improved results for the 2016 and future assessments that will undertake on the basis of a two-year cycle.

The development of Cambodia's FRL is based on guidance from the IPCCC and follows best-practice guidelines of using existing data, and adopting a conservative and incremental approach. Cambodia's FRL has given due consideration to availability and accuracy of data and has been developed with a limited scope of policies and measures, and carbon pools. Improved estimates are planned to be incorporated into future revised versions of FRL as new data and methods become available.

The scale of Cambodia's FRL is national, and its scope covers deforestation and afforestation. UNFCCC guidelines recommend inclusion of five carbon pools that include above ground biomass, below ground biomass, dead wood, litter, and soil organic matter. The inclusion of these pools by a REDD+ country is subject to technical parameters and availability of accurate, and reliable data. Based on Cambodia's context the FRL aims to initially assess GHG emissions

and above and below ground carbon pools. Other carbon pools such as dead wood, litter, and soil organic matter will be added at a later stage. The FRL reference period is 2006-2014 with an eight-year rolling average approach. Activity data is based on spatially explicit observations of land use categories and conversions between the years 2006, 2010 and 2014; and the update cycle is two years to ensure rapid results that can inform policy and measures. Country-specific emission factors for key categories (Tier 2) based on existing forest inventory data, aided by default emission factors for other categories have been used to develop the FRL.

Future plans include periodic review to incorporate emerging data and methods. In addition, subject to technical considerations, future revisions to the FRL could include other carbon pools of dead wood, litter and soil organic matter; and improved emission factors for accuracy. The FRL would be updated once the first National Forest Inventory (NFI) is complete and activity data for the period 2016 onwards is available.

5.3.2 National Forest Monitoring System

Cambodia's NFMS will monitor information relevant to measurement, reporting and verification (MRV) of REDD+ activities, and support broader forest sector policies and programmes, including the NFP, NPASMP and SPFF. The design of Cambodia's NFMS uses a phased approach that incorporates inclusion of improved methods, data, and opportunities from strengthened capacity and evolving technology. This will ensure that the NFMS continues to provide timely, reliable, and accurate information that informs policy and practice to address deforestation and forest degradation drivers in Cambodia.

Cambodia's NFMS has been developed in keeping with its national circumstances, capabilities, and priorities and relies on existing institutional arrangements, with provision for capacity building. The NFMS is also compatible with IPCC guidelines and with relevant UNFCCC COP decisions. Cambodia aims to obtain Tier 2 or higher level standards associated with GHG inventories that includes assessment of five carbon pools.

The conceptual design of Cambodia's NFMS aims to perform two broad functions of MRV and monitoring. The MRV function is divided into the three elements of measurement, reporting and verification. The measurement activity will focus on GHG inventories, the Satellite Land Monitoring System (SLMS), and the NFI. The monitoring function will focus on REDD+ activities, policies and measures and consists of a monitoring component and a data management component.

Cambodia SLMS has been producing national forest cover maps every four years from 2002 onwards. National forest cover maps of 2006 and 2010 have been upgraded to be consistent with the six land use classes defined by the IPCC, and a 2014 map has been produced as per IPCC classes. Further accuracy assessments of 2006 and 2010 maps will be undertaken. The NFMS will focus on forest land cover changes between six land use/cover classes particularly land use/cover change between forest and non-forest areas, and to monitor effectiveness and outcomes of REDD+ policies and measures. To ensure improved monitoring of forest cover change Cambodia has decided to undertake land use assessment every two years and production of the 2016 map has already been started, with plans to produce maps in 2018 and 2020. An assessment of the land use assessment cycle will be undertaken in 2020 and significant capacity building is planned for upgrading skills in satellite image interpretation, and associated technologies.

The NFI will generate accurate data on biomass volumes of forests of different types, age, density, and location that will be used to calculate emissions and removals of forest carbon. Existing data on tree biomass has already been analysed and emissions factors determined for evergreen forest, semi-evergreen forest, deciduous forest, forest regrowth, inundated forest, forest plantation, mangrove, and bamboo. The NFI will target all the five carbon pools in a phased manner with an implementation cycle of four to five years. Development of the NFI has already started with completion of the design, and ongoing capacity building and training. The first cycle of the NFI will be conducted during the period 2018-2021 once assurance of adequate quality control has been achieved. The second cycle of the NFI will be started after 2022 after a detailed review of the design and methodology of the first NFI.

The purpose of the national GHG inventory in the forestry sector is to estimate and report on climate change mitigation impacts from implementation of REDD+ actions. Cambodia prepared and submitted its second national communication to the UNFCCC in 2016. GHG data will be updated for the third national communication and the first BUR. The first BUR is planned to be submitted to the UNFCCC in 2018 along with a technical annexure for results-based payments. The gain-loss method was used in preparing the national communication and due considerations will be given to the stock difference method in order to raise the tier level. A decision on the selection of the method will be made along with the results and progress of NFI cycles.

5.3.3 Safeguards Information System

REDD+ participating countries are required to establish a SIS that provides information on how the UNFCCC Cancun safeguards have been addressed and respected. This requirement is essential for countries who are seeking to become eligible for results-based payments. Cambodia has undertaken significant analytical work for the design of its SIS that includes development of a set of safeguards, principles and criteria, and a gap analysis of policies, laws and regulations. The results of the gap analysis indicate that the RGC has in existence an adequate framework to address social safeguards, but would need to address the environmental risk of reversals and displacement. The process of design of the SIS is embedded in a participatory and consultative process that ensured and provided adequate opportunity for all stakeholders to provide inputs through a series of sub national, and national consultations.

The anticipated ENRC has several elements that will make a direct and positive contribution to several elements of the national policy framework and on Cambodia's REDD+ activities, especially safeguards. This includes a priority to social and environmental safeguards, remedial action through grievance redress mechanisms, and creation of multiple institutional mechanisms to address non-compliance.

The Cambodia SIS will take guidance from the ENRC and build on existing and new institutional mechanisms and arrangements. In addition national standards of social and environmental safeguards will be strengthened and procedural documentation, guidelines and manuals for effective management of safeguards will be produced. A strong impetus will be provided to orientation and capacity building programmes for staff from forestry sector agencies and institutional arrangements for safeguards management will be established. These measures will ensure that Cambodia is well positioned to manage an effectively functioning SIS that provides timely and transparent information on how Cambodia addresses and respects the Cancun safeguards.

6. INSTITUTIONAL ARRANGEMENTS

Implementation of the NRS will be undertaken by forestry sector ministries and agencies as per the forest resources and lands managed by them. Implementation of the NRS will be guided by the principles of good governance; inclusiveness, by ensuring full and effective stakeholder participation; cost efficiency; and accountability.

Existing national mechanisms such as the REDD+ Taskforce (RTF), Technical Teams, Consultation Group and Gender Group will continue to have a role in the Cambodia REDD+ transition from readiness to implementation during the period 2017-2021.

REDD+ Taskforce: The national REDD+ Taskforce is composed of representatives from the NCSD and seven ministries with a mandate to oversee the development of Cambodia REDD+ readiness process. The government agencies represented in the Taskforce are: (1) NCSD (2) MoE, (3) MAFF, (4) Ministry of Economy and Finance (MEF), (5) Ministry of Land Management, Urban Planning and Construction (MLMUPC), (6) Ministry of Interior (MoI), (7) Ministry of Rural Development (MRD), and (8) Ministry of Mines and Energy (MME). The Taskforce will be responsible for the overall management of the REDD+ readiness process and will remain the primary coordination and decision making body within the Government of Cambodia. The RTF will also have responsibility for reviewing key outputs and decisions to ensure they are appropriate to Cambodia's context and will take the lead in the implementation of the national REDD+ strategy and developing the implementation framework.

The RTF will be supported by its Secretariat and report to the RGC through the NCSD. RTF will also update and report on the progress of NRS implementation to their respective ministries. The role and mandate of the RTS will be reviewed as required and its terms of reference revised to ensure it continues to provide effective management and oversight to achieving the goal of the NRS.

REDD+ Technical Teams: Four technical teams on (1) Safeguards, (2) Benefit Sharing, (3) Demonstration, and (4) MRV were established by the RTF. These teams are responsible for developing technical recommendations on their subject matter. Members of these teams include technical staff from different government agencies. Representatives from civil society, indigenous peoples and non-governmental organizations also have representation on these technical teams.

Consultation Group: The consultation group is represented by two elected representatives from

nine constituencies in Cambodia. Those constituencies include representatives from community forests, community protected areas, fisheries conservation areas; indigenous peoples; local NGOs; national NGOs; international NGOs, the private sector, and academic institutions. The consultation group provides a forum to represent the views of local stakeholders, especially civil society and NGOs in Cambodia's REDD+ readiness process, including the preparation of the NRS.

Gender Group: The gender group was established by the RTF to build awareness on gender issues among members of the RTF, consultation group and technical teams and to review and provide gender-specific inputs to the NRS. The four members of the gender group are affiliated with FA and FiA of MAFF, MoE, and the Ministry of Women's Affairs (MoWA).

REDD+ Taskforce Secretariat: The mission of the REDD+ Taskforce Secretariat (RTS) is to support the effective and efficient development of measures for REDD+ in Cambodia through providing support to the REDD+ Taskforce. The RTS is responsible for implementation and execution of the work plan of the RTF. The RTS has to operationalize the vision of the RTF for development of a national REDD+ programme through mobilizing and coordinating technical and financial activities and support from government agencies, development partners, NGOs and other stakeholders. The RTS is the primary contact point and coordination mechanism at operational level for REDD+ in Cambodia.

7. FINANCING APPROACH

During Phase I of NRS implementation 2017-2021, the RGC will prioritize access to upfront non-results-based finance from bilateral and multilateral development partners, and supplement allocations from its national budget. This approach will enable the RGC to consolidate its REDD+ readiness process and to transition to implementation. The RGC will also consider market-based finance opportunities subject to specific criteria. A specific timeline for results-based payments for Phase II will be determined in 2021.

The RGC has already established several national funds and is considering additional funds to establish mechanisms for sustainable financing of its conservation areas, forest and biodiversity resources. These include the National Forestry Development Fund (NFDF) that will be managed by MAFF; and multiple funds being proposed by the MoE in the ENRC that include environmental trust funds, an environment and social fund, and a collaborative management fund.

Environmental trust funds may include conservation trust funds, wildlife trusts, climate and forest funds, rehabilitation and restoration funds, or other forms of delivery of environmental, social and economic benefits. The MoE shall duly establish by legal instrument funding categories, guidelines and priorities for the establishment and operation of environmental trust funds.

The NRS will take due guidance from RGC's existing and evolving finance management mechanisms and support these mechanisms as promising channels for effective management and utilization of REDD+ finance and the implementation of the NRS. Emerging lessons on the implementation of these funds will guide the choice and option of a funds-based approach for REDD+. As and when established, the REDD+ fund would adhere to internationally accepted principles of transparency, accountability, effectiveness, equity and efficiency. In addition modalities and requirements of development partners who provide up front non-results based finance would be negotiated on a case by case basis.

8. MONITORING AND EVALUATION

An Action Plan that will have a results framework, and a monitoring and evaluation (M & E) plan will be developed to fast-track implementation of the NRS. The results framework will be nested within the national climate change M&E framework that includes reporting requirements to the UNFCCC and will be developed by the MoE.

Developing a results framework and M & E plan for the NRS will create an enabling environment of accountability and learning. These instruments will contribute to effective and timely implementation, strengthen accountability and transparency, and promote participatory and open learning. The framework will also have indicators that allow for sustained focus to track delivery of results and benefits to vulnerable communities, indigenous peoples, and women. Collection of gender disaggregated data would be prioritized.

9. CONCLUSION

The Cambodia National REDD+ Strategy provides a roadmap for the implementation of policies and measures to address drivers of deforestation and forest degradation. Successful implementation of the NRS will depend on transformative actions related to the management and governance of natural resources and forest lands in Cambodia. This will further depend on the strengthening of institutions, regulations, mechanisms and inter-ministerial coordination.

To achieve these transformative actions adequate and appropriate capacity will need to be created; procedures and regulations would need to become efficient and transparent; and national mechanisms and inter-ministerial coordination would require better integration.

The NRS will create awareness and strengthen engagement of stakeholders and the public to participate actively in effective implementation of policies and regulations that will lead to improved management of natural resources, forest lands, biodiversity conservation, and sustainable development. This will make a significant contribution to Cambodia's shift towards low carbon pathways, a green economy and contribute to national and global climate mitigation that will help realise the vision of Cambodia's REDD+ strategy.

10. APPENDIX

10.1 Appendix 1: NRS Strategic Framework

Cambodia National REDD+ Strategy

Strategic Framework

VISION

Contribute to national and global climate change mitigation through improving the management of its natural resources and forest lands, and biodiversity conservation and sustainable development.

MISSION

Strengthen the functioning and capacity of national and sub-national institutions for effective implementation of policies, laws and regulations to enhance management of natural resources and forest lands, and biodiversity conservation.

<table>
<tr><th colspan="3">STRATEGIC OBJECTIVES</th></tr>
<tr>
<td>GOAL
Reduce deforestation and forest degradation while promoting sustainable management, conservation of natural resources and contribute to poverty alleviation</td>
<td>Improve management and monitoring of forest resources and forest land use

- Strengthen management of forest conservation areas, such as protected areas and flooded and mangrove conservation areas
- Promote forest land tenure security through forest land classification, zoning, demarcation, and registration
- Strengthen law enforcement activities to address unauthorized logging, and encroachment
- Monitor the status of ELCs and SLCs for compliance with regulations
- Support harmonization of legal frameworks for effective management of forest resources
- Strengthen regulatory framework and capacity for social and environmental impact assessment and compliance
- Strengthen capacity for data management and establish decision support systems for forest and land use sector.</td>
<td>SCOPE
Prioritize deforestation and address degradation later

SCALE
Prioritize national approach under UNFCCC mechanism

POOLS
Prioritize above and below ground biomass; address dead wood, litter and soil carbon later</td>
</tr>
</table>

PHASES <u>2017-2021</u> Consolidation; mobilize upfront financial resources; transition to implementation <u>2022-2026</u> Results-based phase operational	**Strengthen implementation of sustainable forest management** - Strengthen and scale up community-based forest management - Engage and encourage the private sector to implement alternative and sustainable supply chains from agro industrial plantations, and to reduce emissions - Expand afforestation, reforestation and restoration activities - Enhance timber supply and wood-based energy sourced from community-based forest management areas and private plantations to reduce pressure on forest areas - Promote effective, equitable, sustainable management and use of forests, forest lands and non-timber forest products - Identify and implement alternative and sustainable livelihood development programmes for local communities most dependent on forest resources. **Mainstream approaches to reduce deforestation, build capacity and engage stakeholders** - Support mechanisms to mainstream policies and measures that reduce deforestation in relevant government ministries and agencies - Strengthen national and sub national capacity for improved coordination mechanisms for national land use policy and planning - Strengthen capacity, knowledge and awareness of stakeholders to enhance their contribution to reducing deforestation and forest degradation - Encourage public engagement, participation and consultations in forestry and land use planning, and promote the involvement of multiple stakeholders - Strengthen capacity of academic and research institutions in training, research and technology development associated with forestry and land use - Establish partnerships with development partners in building knowledge and human resources related to forestry, land use and climate change.	**RESULTS** By 2026 reduce annual deforestation by half compared to the rate during FRL period of 2006-2014

10.2 Appendix 2: List of Protected Area in Cambodia

No.	PROTECTED AREA	Area (Ha)
	National Park 12	**1,720,269.35**
1	Preah Soramarith Kosamak "Kirirom"	35,232
2	Preah Munivong "Bokor"	154,458
3	Kep	1,152
4	Pheah Sihanouk "Ream"	15,000
5	Botum Sakor	171,250
6	Preah Cheyvarama "Phnom Kulen"	37,500
7	Virachey	332,500
8	Vensai Siempang	57,469
9	Central Cardamom	401,313
10	O'Yadao	101,348
11	Southern Cardamom	410,392
12	Koh Rong	2,655.35
	Wildlife Sanctuary 18	**3,684,328**
13	Phnom Aural	253,750
14	Peam Krasop	23,750
15	Phnom Somkos	333,750
16	Ronien Daun Sam	178,750
17	Kulen Promtep	402,500
18	Beng Per	242,500
19	Lomphat	250,000
20	Phnom Prich	222,500
21	Phnom NamLyr	47,500
22	Snoul	75,000
23	Prey Lang	431,683
24	Preah Roka	90,361
25	Western Siempang	65,389
26	Chhaeb	190,027
27	Tatai	144,275
28	Koe Seima	292,690
29	Sre Pok	372,971
30	Siem Pang	66,932
	Protected Landscape 8	**149,347.30**
31	Angkor	10,800
32	Banteay Chhmar	81,200

33	Preah Vihear	5,000
34	An Long Pring	217
35	North TonleSap	31,159
36	Boeung Prek Lpov	8,305
37	Ang Trapeng Thmor	12,650
38	Boeng Prektub	16.30
Multiple Use Area 5		**409,669**
39	Dong Peng	27,700
40	Samlaut	60,000
41	Tonle Sap	316,250
	Boeng Chhmar Core Area (Ramsar Site)	(14,560)
	Prek Toal Core Area (Ramsar Site)	(21,342)
	Stung Sen Core Area	(6,355)
42	Punchearkrek	199
43	Kbal Chay	5,520
Ramsar 4		**14,600**
44	Stung Treng	14,600
	Koh Kapi	(1,200)
	Boeng Chhmar	(14,560)
	Prek Toal	(21,342)
	Natural Heritage Park 1	**24,654**
45	Phnom Tberng	24,654
46	**Biodiversity Corridor of Protected Area 3**	**1,427,940**
	North East Corridor	757,661
	North West Corridor	500,810
	Cardamom Corridor	169,469
	Total	**7,430,807.65**

Note:

1. Multiple Use Area of the Tonle Sap Lake Biosphere Reserve divided into three core areas: Boeng Chhmar, Prek Toal and Stung Sen
2. Protected Area Biodiversity Corridor divided into three corridors: Northeast, Northwest and Cardamom
3. Koh Kapi Ramsar site located in Peam Krasop Sanctuary and Botum Sakor National Park.

10.3 Appendix 3: Glossary

Carbon Dioxide – CO_2
A naturally occurring gas, also a by-product of burning fossil fuels from fossil carbon deposits, such as oil, gas and coal, of burning biomass and of land use changes and other industrial processes. It is the principal anthropogenic greenhouse gas that affects the Earth's radiative balance.

Carbon Emission
The total amount of greenhouse gases produced to directly and indirectly support human activities, usually expressed in equivalent tons of carbon dioxide (tCO_2e).

Carbon Removal
Any process, activity or mechanism that results in the net removal of greenhouse gases from the atmosphere.

Displacement
The effort of arresting deforestation and forest degradation in one area may also result in the pressures of deforestation and forest degradation being shifted to other ecosystems of importance for the conservation of biodiversity.

Forest Reference Level – FRL
One of the elements to be developed by developing country Parties implementing REDD+ activities (according to paragraph 71 of decision 1/CP.16) in order to be eligible for results-based finance under the UNFCCC. Reference levels are expressed as tonnes of CO_2 (tCO_2e) equivalent per year for a reference period against which the emissions and removals from a results period will be compared. Thus, reference levels serve as benchmarks for assessing each country's performance in implementing REDD+ activities. Reference levels need to maintain consistency with the country's greenhouse gas inventory estimates.

Greenhouse Gas – GHG
The atmospheric gases responsible for causing global warming and climate change. The major GHGs are carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). Less prevalent - but very powerful - greenhouse gases are hydro fluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6).

Market Based Mechanism
Carbon market mechanism within the carbon legal framework bound by national, regional or international agreements. This mechanism is driven by the obligation of institutions and individuals.

National Forest Monitoring System – NFMS
This system will allow countries to monitor the performance of REDD+ policies and measures in mitigating climate change, deforestation in protected areas and logging concessions, as well as national policies and measures in the forestry sector. NFMS for REDD+ vary in structure and function from country to country. Most are designed in a way that can also be used for other monitoring purposes in addition to monitoring and reporting for REDD+.

Reducing Emissions from Deforestation and Forest Degradation - REDD+
The five activities listed in the Cancun Agreements that developing countries are encouraged to implement to reduce emissions and enhance removals from the forest sector: (1) reducing emissions from deforestation, (2) reducing emissions from forest degradation, (3) conservation of forest carbon stocks, (4) sustainable management of forests, and (5) enhancement of forest carbon stocks. Developing countries stand to receive results-based finance from the effective implementation of these activities if they lead to measurable mitigation of GHG emissions.

Results Based Payment - RBP
RBP is the payments that a country receives for the successful implementation of actual reductions of forest carbon emissions or enhanced removals of atmospheric carbon by forests that have been verified according to the UNFCCC process against an established FREL, and achieved through the implementation of PAMs in the context of respecting and addressing relevant social and environmental safeguards.

Reversal
Re-emission of carbon stored in terrestrial sinks, such as forests and soils, when disturbed by natural phenomena or human intervention.

Safeguards
Safeguards are procedures and approaches that can help to ensure that REDD+ activities "do no harm" to people or the environment, but rather enhance social and environmental benefits.

Voluntary Carbon Market - VCM
Carbon market mechanism outside the carbon legal framework not bound by any international agreement. This mechanism is driven by voluntary commitments from institutions (i.e. Energy Company, Aviation Company) and individuals.

別添資料 6

収集資料リスト

収集資料リスト

番号	資料の名称	言語	発行年	形態	版型	ページ数	オリジナル/コイーの区別	内 容
カンボジア森林管理に関する情報								
[1]	Completion Report of Accuracy Assessment Report (Draft Final March 2007), GRAS	英語	2007	PDF形式	A4	24	コピー	2010年版森林図精度検証報告（原稿）
[2]	A decade in forest management and planning in Cambodia	英語	2007	PDF形式	A4	42	コピー	国家森林計画策定に資するために、森林管理の現状を分析したもの。
[3]	Cambodia Forestry Outlook Studya	英語	2010	PDF形式	A4	39	コピー	FAOによるアジア太平洋地域の森林セクターの分析
[4]	Final Draft Report on ORGANISATIONAL ANALYSIS OF THE FORESTRY ADMINISTRATION IN THE MINISTRY OF AGRICULTURE, FORESTRY & FISHERIES IN THE ROYAL GOVERNMENT OF CAMBODIA	英語	2007	PDF形式	A4	27	コピー	カンボジア森林局の組織と機能oの分析
[5]	NATIONAL FOREST POLICY REVIEW	英語	?	PDF形式	A4	16	コピー	カンボジアの森林政策レビュー
[6]	Cambodia’s National Forest Programme, Background Document	英語	2010	PDF形式	A4	82	コピー	カンボジア森林計画　付属書類
[7]	NATIONAL FOREST PROGRAMME 2010-2029	英語	2010	PDF形式	A4	146	コピー	カンボジア森林計画
[8]	Cambodia's National Forest Programme, Framework Document 4th Draft	英語	2009	PDF形式	A4	71	コピー	カンボジア森林計画　設計書
[9]	LAW ON FORESTRY	英語	2002	PDF形式	A4	36	コピー	森林法
[10]	Rectangular Strategy III		2013		A4		コピー	国家開発計画　フェーズIII
カンボジア或いは近隣地域の森林に関する情報								
[11]	Stand dynamics of tropical seasonal evergreen forest in central Cambodia	英語	?	PDF形式	A4	24	コピー	中部カンボジアの季節常緑林の分析
[12]	BRIEF ON NATIONAL FOREST INVENTORY, NFI, CAMBODIA, MAR-SFM Working Paper 15/ 2007	英語	2007	PDF形式	A4	18	コピー	カンボジアの国家森林インベントリーの現状に関する報告書
[13]	Appendix 1 Forest Research Growth and Yield, List of Plots, INVENTORY HANDBOOK - Operational Coupe Level - 2003	英語	2003	PDF形式	A4	4	コピー	カンボジアの森林インベントリープロット位置リスト

番号	資料の名称	言語	発行年	形態	版型	ページ数	オリジナル/コイーの区別	内　容
[14]	Conservation of Prey Long Forest Complex, Cambodia, WORKING PAPERS FOREST & LANDSCAPE 50 / 2010	英語	2010	PDF形式	A4	28	コピー	プレイロン地区の調査のまとめと、同地区の保護政策の要点の抽出
[15]	Lessons learned from develoing the Seima REDD project in Cambodia, presented by Dr. Tom Evans WCS	英語	2011	PDF形式	A4	51	コピー	セイマ保護林REDD+プロジェクト開発のレビュー
[16]	Cambodia Readiness Plan Proposal on REDD+ (Cambodia REDD+ Roadmap) Version 3.3, 10 January 2011	英語	2011	PDF形式	A4	98	コピー	カンボジアのREDD+ Readinessロードマップ
[17]	Review of Cambodia's REDD Readiness: Progress and Challenges	英語	2011	PDF形式	A4	50	コピー	カンボジアのREDD+準備状況のレビュー
[18]	Cambodian Tree Speices Monographs	英語	2004	PDF形式	A4	61	コピー	カンボジアの主要樹種の解説
[19]	National Report on Mangroves in South China Sea, Cambodia	英語	?	PDF形式	A4	18	コピー	カンボジアの南シナ海側のマングローブの状況報告書
[20]	Wood Densities of Tropical Tree Species	英語	1992	PDF形式	A4	18	コピー	熱帯地域の主要樹種の密度データ
[21]	Tree volulme and biomass allometric equations of Cambodia	英語	2012	PDF形式	A4	32	コピー	カンボジアのアロメトリー式の現状分析と、提言
[22]	Technical issues related to implementing REDD+ programs in Mekong countries	英語	2009	PDF形式	A4	91	コピー	REDD+の技術面に関する能力強化マニュアル
[23]	Elaboration of cartographic tools for reforestation CDM and REDD project activities in Cambodia Final Report	英語	2009	PDF形式	A4	85	コピー	カンボジアの地図データの分析と、森林減少のベースライン設定の考察
[24]	Cambodia Forest Cover 2010	英語	2011	PDF形式	B5	20	コピー	2010年版森林図の内容説明書
[25]	Community forest management planning mannual	英語	2011	PDF形式	A4	77	コピー	村落林業の計画策定用マニュアル
[26]	Land cover and forest classification systems of Cambodia	英語	2013	PDF形式	A4	70	コピー	カンボジアの土地被覆および森林分類システムの分析
MRV/REL手法解説書								
[27]	Guidelines for REDD+ Reference Levels: Principles and Recommendations	英語	2011	PDF形式	A4	14	コピー	REDD＋参照レベル設定のためのガイドライン
[28]	Modalities for REDD+ Reference Levels: Technical and Procedural Issues, Prepared for The Government of Norway	英語	2011	PDF形式	A4	28	コピー	REDD＋参照レベルに関する解説書