

Regional Asian Workshop on “Estimating the Opportunity Costs and Implementation Costs of REDD+ for the National Planning Process”

GHG Emission/Removal Estimation for Land Use Change and Forestry 2000 Cambodia

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Outline

1. **GHG Calculation Methodology**
2. **Uncertainties**
3. **Issues, problems and gaps relate to National GHG Inventory**
4. **Future Inventory**
5. **Proposed National coordination arrangement for REDD+**

1. GHG Calculation Methodology

The priority calculations of emission/removal from land-use change and forestry (LUCF) focus on three activities which are sources or sinks of carbon dioxide (CO₂):

1. Changes in forest and other woody biomass stocks
2. Forest and grassland conversion
3. Abandonment of managed lands.

1.1 Changes in forest and other woody biomass stocks

Step 1 – Estimate of Total Carbon Content in Annual Growth of Logged and Planted Forests

- Data on the area of forest/biomass in kilohectares (kha) is required
- Unavailable data for the year 2000, therefore the forest cover assessments conducted in 1992/93, in 1996/97 by the Forest Cover Monitoring Project MRC/GTZ (FCMP) and FA 2005/06 were used to interpolate the average change per year of forest cover.

1.1 Changes in forest and other woody biomass stocks

Data on forest cover in Cambodia

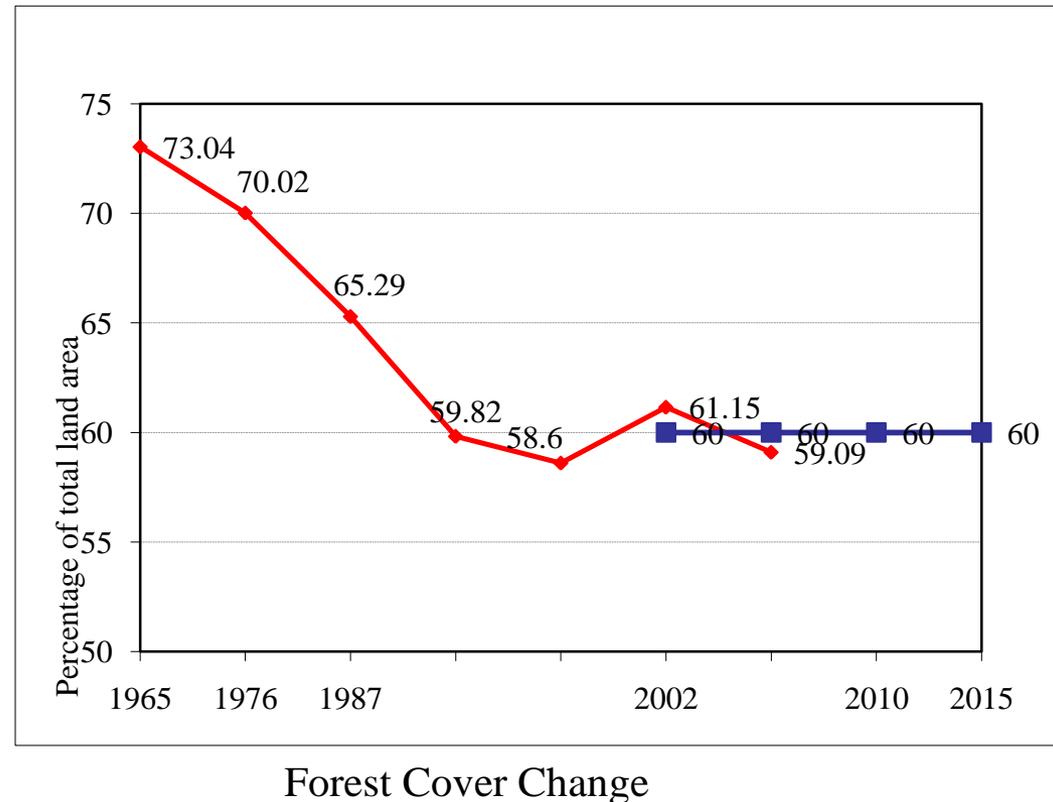
Cambodia								
Forest	Area 92/93	%	Area 96/97	%	Change (ha)	Change by year	Estimated Area 99	Estimated Area 00
Evergreen	4,039,877.00	22.26	3,986,719.00	21.96	-53,158.00	-13,289.50	3,960,140.00	3,946,850.50
Evergreen Dense	654,442.00	3.61	625,177.00	3.44	-29,265.00	-7,316.25	610,544.50	603,228.25
Evergreen Disturbed	3,255,533.00	17.94	3,183,395.00	17.54	-72,138.00	-18,034.50	3,147,326.00	3,129,291.50
Evergreen Mosaic	129,902.00	0.72	178,147.00	0.98	48,245.00	12,061.25	202,269.50	214,330.75
Semi-evergreen	1,534,543.00	8.45	1,505,326.00	8.29	-29,217.00	-7,304.25	1,490,717.50	1,483,413.25
Mixed Dense	99,124.00	0.55	95,560.00	0.53	-3,564.00	-891.00	93,778.00	92,887.00
Mixed Disturbed	1,325,353.00	7.30	1,284,446.00	7.08	-40,907.00	-10,226.75	1,263,992.50	1,253,765.75
Mixed Mosaic	110,066.00	0.61	125,320.00	0.69	15,254.00	3,813.50	132,947.00	136,760.50
Deciduous	4,350,204.00	22.08	4,281,397.00	23.59	-68,807.00	-17,201.75	4,246,993.50	4,229,791.75
Deciduous	4,008,000.00	22.08	3,931,219.00	21.66	-76,781.00	-19,195.25	3,892,828.50	3,873,633.25
Deciduous Mosaic	342,204.00	0.00	350,178.00	1.93	7,974.00	1,993.50	354,165.00	356,158.50
Forest Regrowth	435,618.00	2.40	374,197.00	2.06	-61,421.00	-15,355.25	343,486.50	328,131.25
Inundated	349,476.00	1.93	335,307.00	1.85	-14,169.00	-3,542.25	328,222.50	324,680.25
Inundated Forest Regrowth	21,623.00	0.12	20,819.00	0.11	-804.00	-201.00	20,417.00	20,216.00
Inundated Forest	229,266.00	1.26	219,906.00	1.21	-9,360.00	-2,340.00	215,226.00	212,886.00
Inundated Mosaic	98,587.00	0.54	94,582.00	0.52	-4,005.00	-1,001.25	92,579.50	91,578.25
Mangrove	77,669.00	0.43	72,835.00	0.40	-4,834.00	-1,208.50	70,418.00	69,209.50
Forest Plantation	72,307.00	0.40	82,425.00	0.45	10,118.00	2,529.50	87,484.00	90,013.50
Total Forest	10,859,694.00	57.94	10,638,206.00	58.60	-221,488.00	-55,372.00	10,527,462.00	10,472,090.00

1.1 Changes in forest and other woody biomass stocks (Cont.)

Estimated forest cover by type for the year 2000

Forest Type	Estimated Area Year 2000 (kha)
Evergreen	3,718
Semi-evergreen	1,339
Deciduous	4,176
Inundated Forest	234
Mangrove	69

Source: Forest Administration (2008)



1.1 Changes in forest and other woody biomass stocks (Cont.)

- The default value of IPCC for Carbon Fraction of Dry Matter of 0.5 for all biomass was used.
- The following Annual Growth Rate was used to estimate carbon stock.

Forest/Plantation Type	Annual Growth Rate (t dm/ha)	Source
Accacia spp	7.1	Revised 1996 IPCC& GPG-2003
Eucalyptus spp	15	Revised 1996 IPCC& GPG-2003
Hevea brasiliensis	6.7	CCEAP 2 (2003)
Evergreen	2	FA (2009)
Semi-evergreen	2	FA (2009)
Deciduous	1.5	FA (2009)
Inundated	2	CCEAP 2 (2003)
Mangrove	3	CCEAP 2 (2003)

1.1 Changes in forest and other woody biomass stocks (Cont.)

Step 2 – Estimate of the Amount of Biomass Harvested

- IPCC recommends using FAO data, if local data is not available.
- For the year 2000, an estimated 10,119 kt dm of traditional fuel wood was consumed (FAOSTAT).
- The Forestry Administration reports the 2000 commercial forest product harvest as 187,488 m³ of round wood, and 63,518 m³ of sawlogs, veneer and plywood (FA 2005).
- The IPCC default value for the Biomass Conversion/Expansion Ratio is 0.95 t dm total biomass/m³ for commercial round wood.

1.1 Changes in forest and other woody biomass stocks (Cont.)

Step 3 – Conversion of Wood Harvested to Carbon Removed

- The general IPCC default value for live biomass is 0.5 for the Carbon Fraction.

Step 4 – Estimate of the Net Annual Amount of Carbon Uptake or Release

- The Net Annual Carbon Uptake of 7,420.43 kt is multiplied by 44/12 to yield an equivalent Annual CO₂ removal of **-21,126 Gg**.

1.2 CO₂ Emissions from Forest and Grassland Conversion

Step 1 – Estimate of Biomass Cleared

- The calculations of biomass cleared rely on the forest cover assessments conducted in 1992/93 and in 1996/97 by the Forest Cover Monitoring Project (MRC/GTZ 1998).
- For each forest class, it is possible to estimate the change in land area (kha) between 1992/93 and 1996/97, and the average change per year over the same period.
- Estimated annual forest conversions in the year 2000: 23 kha of evergreen forests, 10 kha of semi-evergreen forests, 21 kha of deciduous forests, 2 kha of inundated forests and 1 kha of mangroves.

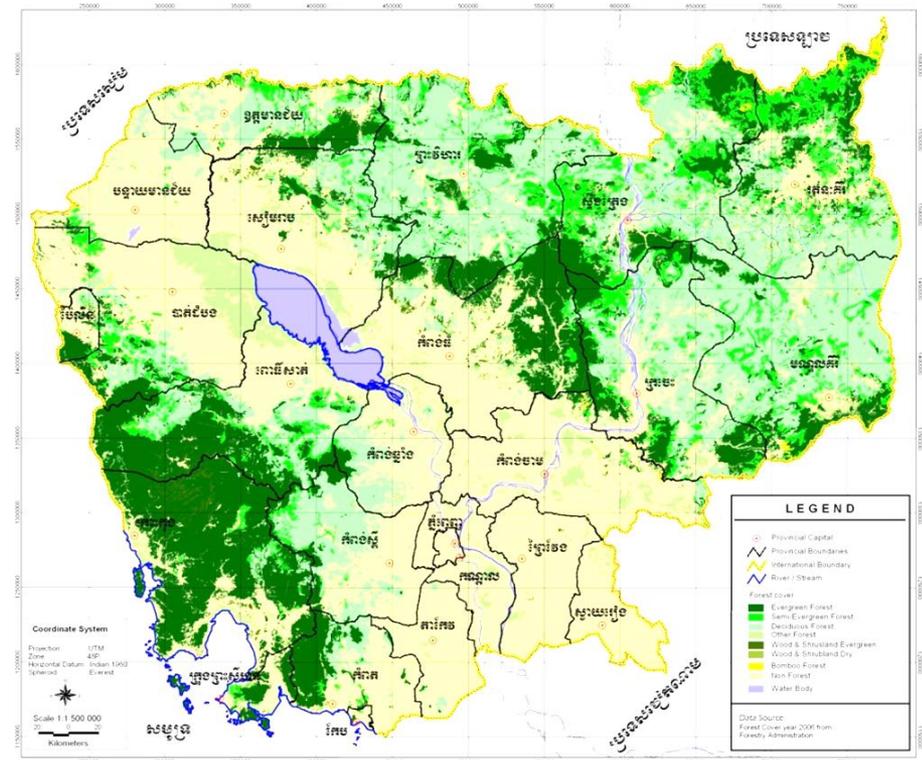
1.2 CO₂ Emissions from Forest and Grassland Conversion (Cont.)

The following Dry Matter in Above Ground Biomass are used

Forest Type	Biomass Before Conversion (t dm/ha)
<i>Evergreen</i>	200
<i>Semi-Evergreen</i>	250
<i>Deciduous</i>	100
<i>Inundated</i>	170
<i>Mangrove</i>	150

Source: CCEAP/MoE

Forest cover map 2006



1.2 CO₂ Emissions from Forest and Grassland Conversion (Cont.)

Step 2&3 – Estimate of Carbon Released by Burning

Aboveground Biomass On-Site and Off-Site

- The IPCC Guidelines default values are 0.5 and 0.5 for the Fraction of Biomass Burned on Site and Off-Site respectively.
- The default value of 0.9 for the Fraction of Biomass Oxidised and 0.5 for the Carbon Fraction of the Aboveground Biomass are used.

Step 4 – Estimate of Total Carbon Released by Burning

Aboveground Biomass On and Off-Site

- Total Carbon Released by Burning Aboveground Biomass On and Off-Site is estimated at 4,212 kt.

1.2 CO₂ Emissions from Forest and Grassland Conversion (Cont.)

Step 5 - Estimate of CO₂ Released by Decay of Aboveground Biomass

- The IPCC default value of 0.5. of the Fraction of Biomass left to decay is used.
- The default value for the average Biomass Left After Conversion is 10 t dm/ha.

Step 6 – Estimate of Total CO₂ Emissions from Forest and Grassland Conversion

- The Total Annual Release of 6,234.20 kt of carbon is estimated and multiplied by 44/12 to yield an equivalent annual CO₂ release of **22,858.73 Gg**.

1.3 Abandonment of Managed Lands

Step 1 – Calculation of Annual Carbon Uptake in Aboveground Biomass (Land Abandoned in the Last Twenty Years)

- Most of the commercial logging in Cambodia occurred in the 1980-2000 period
- Prior to the inventory year, commercial forest concessions were gradually cancelled by government as they had been totally exploited.
- About 1,051 kha of moist/short dry season forests were allowed to regrow towards their natural state as their management reverted to the Forestry Administration.

1.3 Abandonment of Managed Lands (Cont.)

Step 1 – Calculation of Annual Carbon Uptake in Aboveground Biomass (Land Abandoned in the Last Twenty Years) Cont.

- According to the IPCC Guidelines, regrowth rates are dependent on the type of natural ecosystem and the time period considered. Land abandoned regrows at a higher rate towards their natural state during the first 20 years prior to the inventory year.
- The assumption is that mosaic forests, previously exploited for timber, have been allowed to regrow towards their natural state as their management reverted to the Forest Administration.

Step 2 - Calculation of Annual Carbon Uptake in Aboveground Biomass (Land Abandoned More than Twenty Years)

This is assumed to be none because of lack of available data.

1.3 Abandonment of Managed Lands (Cont.)

- IPCC-GPG default values are used for the Average Annual Increment in Aboveground Biomass in the first twenty years: 7 t dm/ha/year for wet forests, 9 t dm/ha/year for moist with short dry season forests, 6 t dm/ha/year for moist with long dry season forests and 6 t dm/ha/year for forest regrowth.
- The default value for Carbon Fraction of Dry Matter is 0.5 for all biomass, as specific values are not available in Cambodia.

Step 3- Calculation of Total CO₂ Removals from Abandoned Lands

- The Total Annual Release was estimated at 5,715.71 kt. This value is multiplied by 44/12 to yield an equivalent Annual CO₂ removal of **20,957.60 Gg**.

Summary of Results

Emissions by source and sink categories for Land-Use Change and Forestry for the year 2000 (Gg)

LUCF Greenhouse Gas Source and Sink Categories	CO₂ Emissions	CO₂ Removals	CH₄	N₂O	Total CO₂eq
Changes in forest and woody biomass stocks	0	-27208.26			-27208.26
Forest and grassland conversion	22,858.73	0	32.06	0.22	23600.36
Abandonment of managed lands		-20,957.60			-20957.60
Total	22,858.73	-48,165.86	32.06	0.22	-24565.50

2. Uncertainties

Uncertainties associated with emission factors

➤ **Use of IPCC default emission values/factors.**

These factors have been measured under particular circumstances which may not accurately reflect the Cambodian context

Uncertainty Associated with Activity data

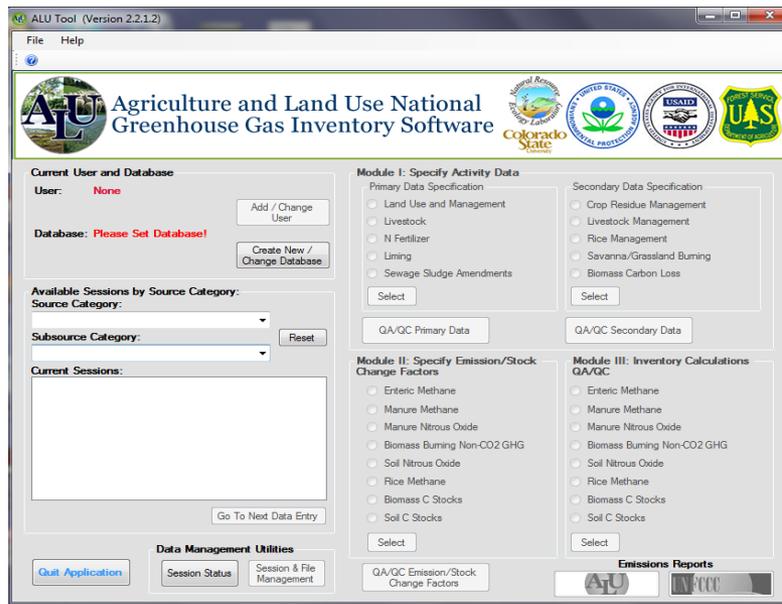
Land Use Change and Forestry	High	<ul style="list-style-type: none">▪ No regular data collection;▪ Inventory based on extrapolation of 1992/93 and 1996/97 forest assessment;▪ Concerns about reliability of harvesting/logging statistics due to illegal logging activities.;▪ No existing soil classification (land use by mineral and organic soil types not available)
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3. Issues, problems and gaps relate to National GHG Inventory

- Lack of sustainable national GHG inventory database, data format, etc.,
- Lack of activity data. e.g., energy balance sheet in the country, livestock, water management for paddy, soil carbon, etc....)
- Lack of researches/studies related to Sector GHG inventory
- The GHG inventory preparation is basically on project base, and most outputs are relying on consultants
- Inadequate capacity of technical and local staffs
- Inadequate in coordination and facilitation among inline government ministries and agencies
- Lack of financial support

4. Future Inventory

- The Third National Communication (NC3) is not yet confirmed.
- Requesting for funding (e.g. from GEF) has not submitted yet.
- For the next inventory, CCD plans to apply ALU software with agriculture and LUCF sectors, while other sectors with UNFCCC Software, LEAP, etc.,

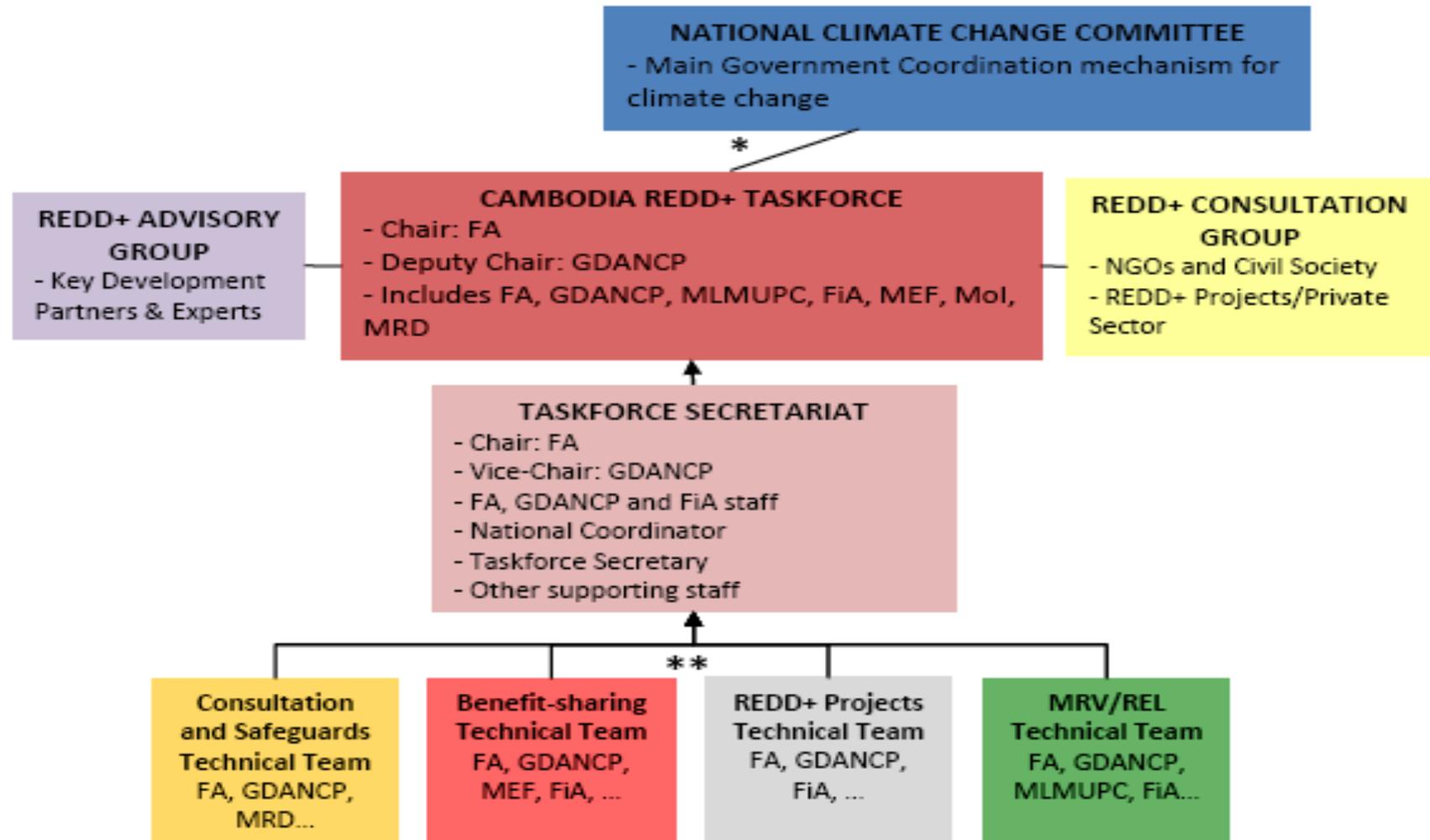


- *To assist national inventory compilers with activity data collection for the majority of greenhouse gas sources in the Agriculture and Land Use, Land Use Change and Forestry Sectors, and*
- *To support users of the Agriculture and Land Use (ALU) National Greenhouse Gas Software Program.*

4. Future Inventory (Cont.)

- Strengthening cooperate with the concerned government institutions and research institutions to improve activity data and emission factors
- Establish data management systems for inventory
- Use on-the-job training approach to build technical capacity of local experts
- Decentralizing GHG inventory work to involved sectors
- Promoting and coordinating CC mainstreaming into relevant sectors
- Strengthening capacity of the NCCC and its Secretariat
- Resource mobilization for addressing CC
- Exchange experts within the region
- Promote cooperation with regional research organizations.

5. Proposed National coordination arrangement for REDD+



* Represents reports from the Taskforce sent to the NCCC

** Taskforce Technical Teams will include Government and non-Government representatives as appropriate

A wide-angle photograph of the Angkor Wat temple complex in Cambodia. The central focus is the main temple structure with its five towers, set against a backdrop of a clear sky with light clouds. A long, straight stone path leads from the foreground towards the temple. The path is flanked by low stone walls and rows of palm trees. The overall scene is bright and clear, suggesting a sunny day.

Thank You

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