

Reporting under the UNFCCC

Overview

Non-Annex I Parties

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Background

- **Articles 4.1 and 12.1** of the Convention:
 - Communicate to the Conference of the Parties (COP) a national inventory of anthropogenic emissions by sources and removals by sinks of all greenhouse gases (GHG) not controlled by the Montreal Protocol, to the extent its capacities permit
- Decisions of the COP for **Parties not included in the Annex I of the Convention**:
 - Guidelines for preparation of National Communications (**Decision 10/CP.2**) – 1996
 - Guidelines for preparation of National Communications (**Decision 17/CP.8**) – 2002 (*new guidelines*)
 - Decisions on work of the Consultative Group of Experts (Decisions 8/CP.5, 31/CP.7 and 3/CP.8)

Why GHG inventories are important?

- Fundamental to evaluate the objective of the Convention and to monitor the implementation of the Convention and the Kyoto Protocol (Annex I Parties)
- Base to evaluate the effectiveness of policies, development of methodologies and for the preparation/evaluation of projections
- Essential for the discussions and the work on future commitments (Annex I Parties)
- Possible contribution to the national work on CDM (monitoring and baselines) (Non-annex I Parties)

Principles and UNFCCC Guidelines for GHG national inventories

Principles:

Transparency, consistency, comparability, completeness and accuracy

- 1996 IPCC Guidelines for National Greenhouse Gas Emission Inventories
- IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (GPG for Land Use, Land-use Change and Forestry adopted for its use in COP-9)

Its use is recommended for non-Annex I Parties:

- ☞ Detailed and transparent presentation of inventory data (uncertainties analysis and key sources assessment)
- ☞ Quality control / Quality assurance
- Use of Table 1 and Table 2 contained in the annex to 17/CP.8
 - ☞ Provision of the worksheets and sectoral tables of the 1996 IPCC Guidelines is recommended (electronic and hard copy format)

IPCC Good Practice Guidance and Uncertainty Management in National GHG Inventories (GPG)

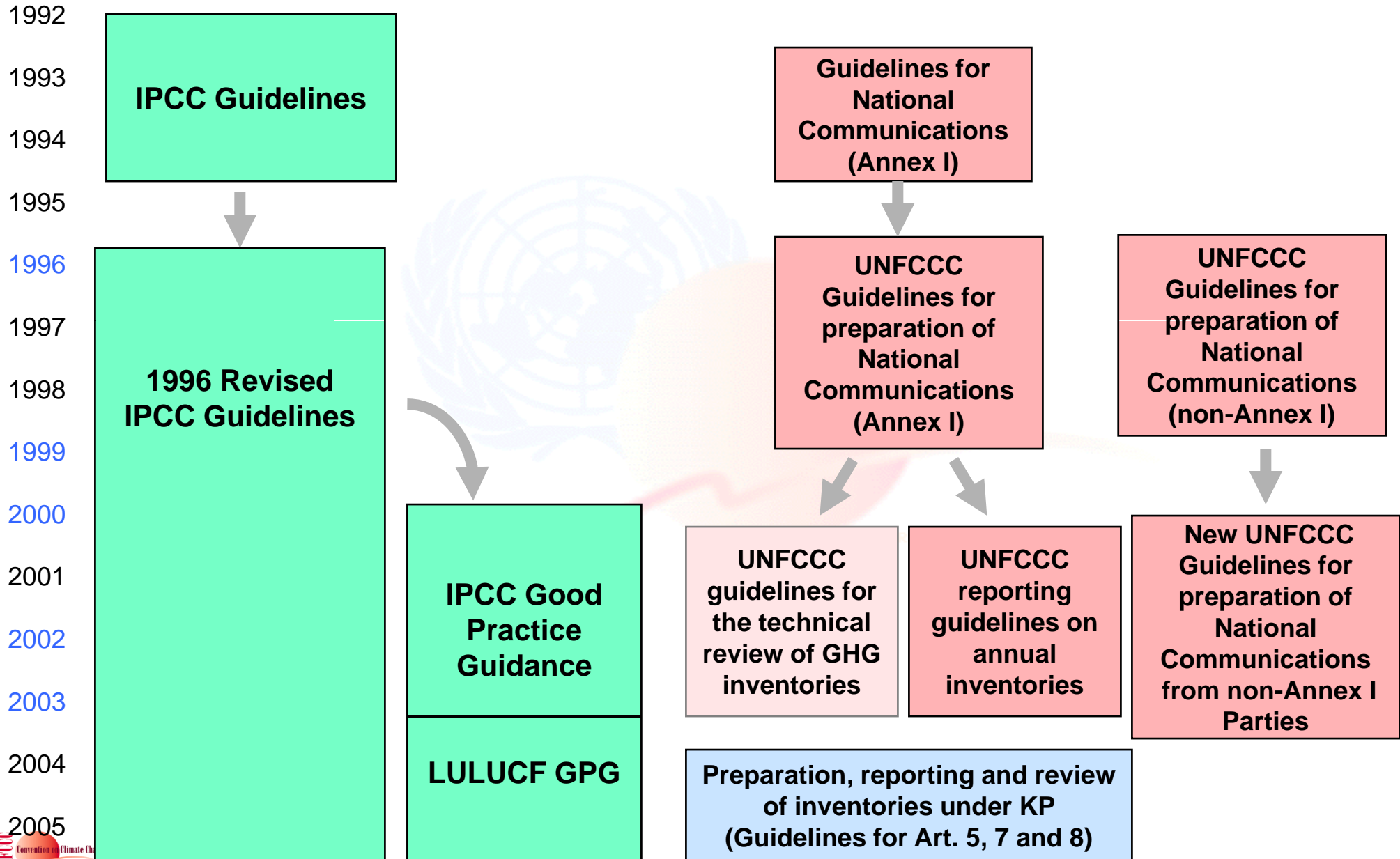
- ✓ GPG provides useful guidance for **selecting** appropriate estimation methods (different tiers), emission factors and activity data
- ✓ It helps in selecting appropriate methods in quantifying and analysing **uncertainty**, in determining **key categories**, in **recalculating** emissions data, and in setting up **quality assurance / quality control** plans

<http://www.ipcc-nggip.iges.or.jp/public/gp/gpgaum.htm>

- ✓ The use of the **GPG for LULUCF** is encouraged for non-Annex I Parties, as appropriate and to the extent possible (Decision 13/CP.9)

<http://www.ipcc-nggip.iges.or.jp/public/gp/lulucf/gp/lulucf.htm>

UNFCCC and IPCC Guidelines



New tools for Parties not included in the Annex I

- Guidelines for preparation of National Communications from Parties not included in Annex I to the Convention (**Decision 17/CP.8**)
- **IPCC Good Practice Guidance** (general part for all sectors and GPG for Land Use, Land-use Change and Forestry)
- **IPCC Emission Factors database** (EFDB)
- **GEF Operational Procedures** for the Expedited Financing of National Communications from Non-Annex I Parties
- **UNFCCC User Manual** for the Guidelines on National Communications from non-Annex I Parties
- CGE training materials, CGE regional hands-on workshops
- Future work for improving the IPCC GHG inventory software to produce “table 1 and 2” including GPG for LULUCF (IPCC and UNFCCC Secretariat)

Guidelines for preparation of National Communications from Parties not included in Annex I to the Convention (Decision 17/CP.8)

Introduction

National GHG inventory is a **key element** of the National Communication

- ✓ Should include information on how the inventory work has been **organized** and **approached**
- ✓ The IPCC diagram containing **various stages** of inventory work may be followed
- ✓ The stages of the inventory from which the new work was started should be described

Guidelines for NC (Decision 17/CP.8)

(II)

Inventory years

- ✓ In the Second NC, the inventory year to be reported is **2000**
- ✓ **LDCs** can choose any year at their discretion
- ✓ It would be preferable if Parties could report for any of the years from 1994 up to, and including 2000, **if data is available**
- ✓ **Second GHG inventory**, it is advisable **to revise the data** provided for the first inventory (revision may facilitate the understanding of possible changes to the first inventory)
- ✓ **Parties wishing to report for years other than for 1990 or 1994 and 2000, are welcome to do so.** This applies also to Parties that are preparing their first or the third NC

Methodologies

- **Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories**

- ✓ Parties should only use the **latest version** (i.e. **Revised 1996**) of the “IPCC Guidelines for National Greenhouse Gas Inventories” (3 volumes)

<http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.htm>

- ✓ The use of IPCC Guidelines is enhanced by the **IPCC inventory software**
- ✓ These Guidelines are **complemented** by the IPCC **GPG**
 - ✓ The **GPG for LULUCF** was adopted by the IPCC and distributed to Parties at COP-9

Reporting

● Institutional arrangements

- ✓ Parties are encouraged to provide information about the procedures and arrangements (e.g. institutional) established in order to **collect and archive data** for inventory preparation, and efforts to make this a **continuous and sustainable process**
- ✓ This is intended to help make inventory preparation **periodic and systematic**, and as far as possible, to allow inventory elaboration by the **same technical team** for all years

● **Direct greenhouse gases**

- ✓ **3 direct GHGs** (CO₂, CH₄, N₂O) should be provided:
 - ✓ on a **gas-by-gas** basis (i.e. no single aggregated figure)
 - ✓ in **units of mass** (generally used: Gg = 1000 tonnes)
- ✓ This information will be reported in **Table 1** contained in the annex to the UNFCCC Guidelines for NC and is greatly facilitated by the use of the **IPCC inventory software** which automatically summarizes this information

Guidelines for NC (Decision 17/CP.8)

(VII)

- **Information on HFCs, PFCs and SF₆**

- ✓ In their Initial NC, some Parties have already reported on emissions of HFCs, PFCs and SF₆
- ✓ **Table 2**, contained in the annex to the UNFCCC Guidelines for NC, provides a framework for the reporting of such emissions

- **Information on CO, NO_x and NMVOCs**

- ✓ This information will be reported in **Table 1** and is greatly facilitated by the use of the **IPCC inventory software** which automatically summarizes it

Guidelines for NC (Decision 17/CP.8)

(VIII)

- **Information on SO_x**
 - ✓ Parties may report SO_x in **Table 1** and its reporting is facilitated by the use of the **IPCC inventory software**
- **Use of reference and sectoral approaches**
 - ✓ Parties are encouraged to estimate CO₂ emissions from fuel combustion **using both methods** and **explain/discuss the difference** between the two results
 - ✓ This can help to further improve future GHG inventories by progressively **reducing this level of uncertainty**
 - ✓ The reporting of both approaches is greatly facilitated by the use of the **IPCC inventory software**

Guidelines for NC (Decision 17/CP.8)

(IX)

- **International aviation and marine bunker fuels**

- ✓ If data on international bunker fuels is available, Parties **should strive to report it**, providing any breakdown of this information, as a **memo item** (i.e. **not included** in the national totals)

- **Global warming potentials (GWP)**

- ✓ Reporting in terms of **aggregate emissions and removals** (i.e. in terms of CO₂ equivalent emissions) serves the purpose of facilitating the comparison between sectors or comparing the relative importance of each direct GHG
- ✓ If a Party chooses to use GWP, it should use those provided by the **IPCC in its Second Assessment Report**, published in **1995** (i.e.: **1** for **CO₂**, **21** for **CH₄** and **310** for **N₂O**)

Guidelines for NC (Decision 17/CP.8)

(X)

● Sources of information

- ✓ It is advisable to describe as precisely as possible the **sources of information (activity data and emission factors) and methodologies used**, especially for country-specific sources and/or sinks which are not part of the IPCC Guidelines
- ✓ This contributes to the **transparency of the information** and helps the reader to understand what was done and how it was done for the estimation
- ✓ It is important for Parties **to identify the data gaps and related problems** and to make links with **future improvements** to be achieved through **capacity-building**, also in order to facilitate further requests for **financial and technical assistance**

● Use of Table 1 and Table 2

- ✓ Non-Annex I Parties are **encouraged to use Table 1 and Table 2** contained in the annex to decision 17/CP.8
- ✓ These tables will be **automatically generated by the IPCC inventory software**, which will be improved by the UNFCCC secretariat in collaboration with the IPCC
- ✓ It is advisable to read carefully the footnotes in Table 1 and Table 2. The only **notation keys** to be used are the ones agreed to by the IPCC and listed in the footnote of Table 1
- ✓ **Particular attention** should be paid as to **how Table 2 should be presented** in order to suit the data available

● **Sectoral tables and worksheets of the IPCC**

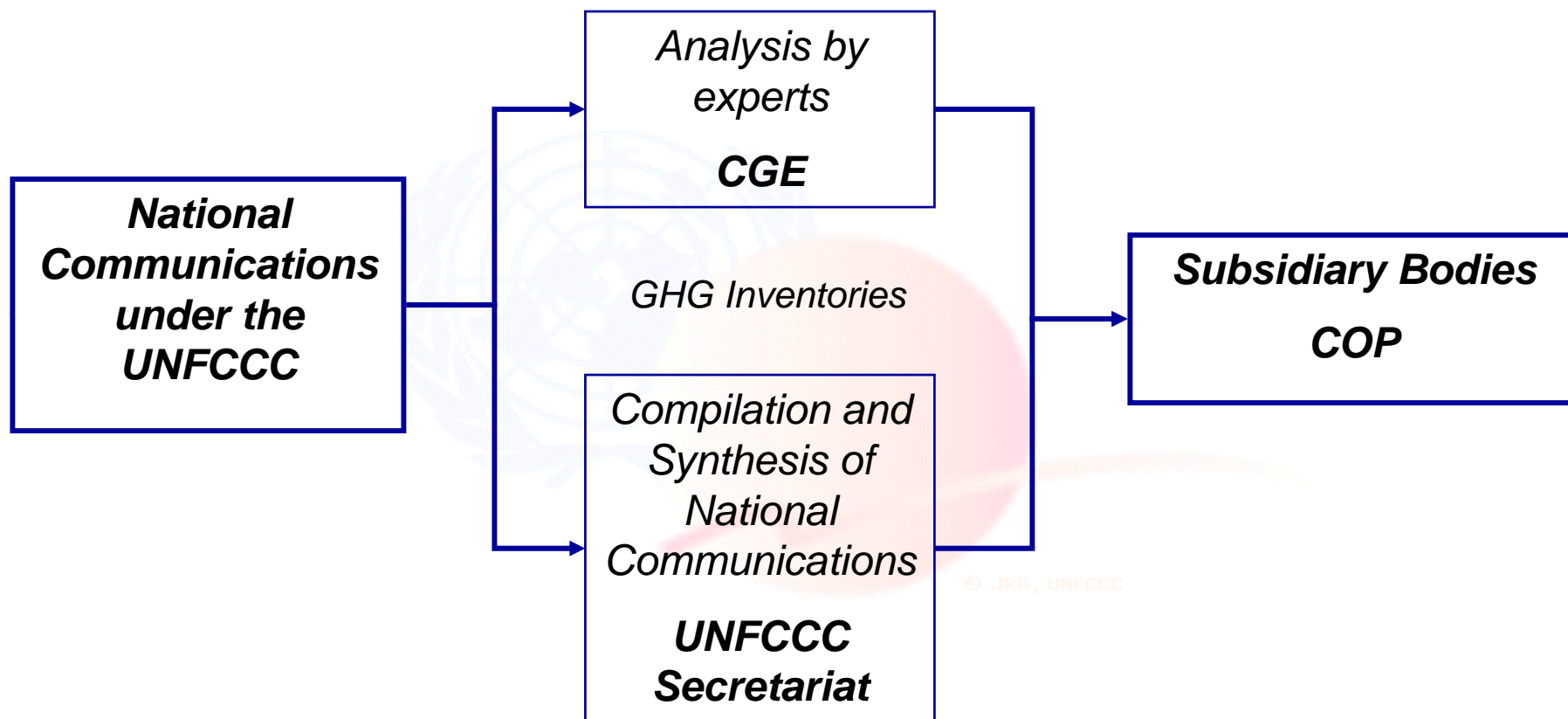
- ✓ The **sectoral tables**, which summarize the emissions by sectors, are **automatically generated** by the **IPCC inventory software**
- ✓ The provision of the **electronic copy** of the worksheets and sectoral tables of the GHG inventory is intended to **facilitate the compilation of data** for the preparation of compilation and synthesis as well as other documents produced by the UNFCCC secretariat. This task can easily be achieved by providing the electronic files generated by the IPCC GHG inventory software in **MS Excel format**:

<http://www.ipcc-nggip.iges.or.jp/public/gl/software.htm>

● **Level of uncertainty**

- ✓ The **GPG** has **substantially improved the methodology** for calculating and managing uncertainties (see chapter 7 of the GPG and chapter 5 of the GPG for LULUCF)
- ✓ A major objective of the IPCC methodology is **to help national experts to reduce uncertainty** in their GHG inventories to the minimum level possible
- ✓ However, the approach also recognizes that **significant uncertainties will remain** despite these efforts, and that these uncertainties will vary widely
- ✓ The provision of such information is intended to help the reader **better understand the information** contained in the national GHG inventory

Consideration of national GHG inventories of Parties not included in Annex I under the UNFCCC



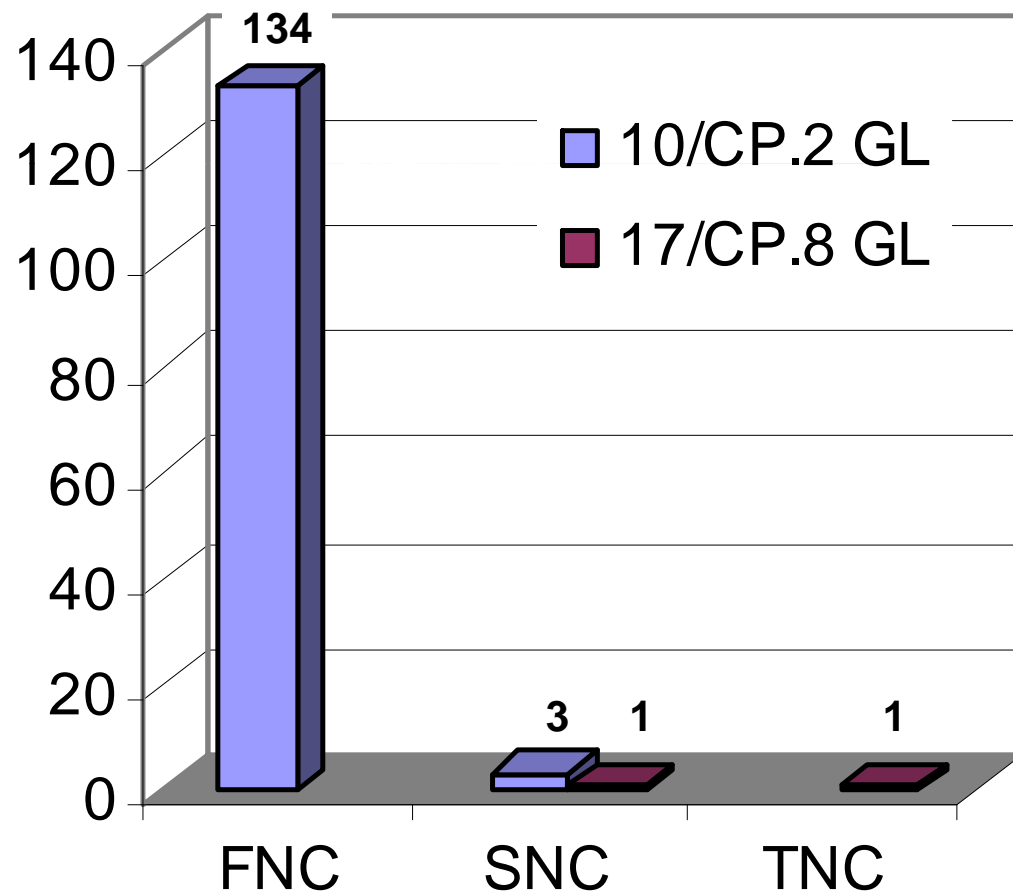
- Do not exist technical feedback to Parties
- Very limited participation of national experts during consideration

Main problems identified in GHG inventories of Parties not included in Annex I

- Limitations in quality and availability of activity data, in most of the cases due to lack of resources
- Difficulties to periodically up-date data and information of inventories by stable national teams
- Use of inappropriate methods for national conditions (particularly for LUCF sector)
- Generalized use of default methods and emission factors
- Use of 1996 IPCC Guidelines (which require up-dating) without use of the GPG (which is its complement)

ALL THESE PROBLEMS ARE CAUSED OR ARE INTENSIFIED BY LACK OF RESOURCES..... FOR THIS REASON IS IMPERATIVE OBTAIN AND USE REASONABLY THE SCARCE RESOURCES AVAILABLE

Non Annex I Parties National Communications Submitted



Final Considerations (I)

The preparation of better inventories is good for:

- Inventories experts, as they gain experience
- Analysis of a number of aspects related to climate change at national level
- Providing useful information for analysis and calculation of emissions reduction in CDM projects

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The periodic preparation of inventories by a stable team of experts not only contributes to gain experience, but also is one of the most influential factors on quality of inventories

Final Considerations (II)

A more precise guidance and defined formats for reporting contribute to better preparation and report of inventories:

- Inventory experts know precisely what information is needed and know how to prepare and report it
- Inventory experts could prepare better and in advance, the elaboration of national GHG inventories
- Inventory experts could elaborate and report more easily GHG inventories, reducing resources needed for more periodically inventories preparation

Experience of Annex I Parties regarding annual inventories, prepared using Guidelines of Decision 3/CP. 5, and especially using electronic format for reporting (CRF), demonstrates benefits of more precise guidance

Final Considerations (III)

- New guidelines adopted by Decision 17/CP.8 offer more precise guidance for GHG inventories preparation and reporting
- Some elements are mandatory and recommended (“shall and should”) and others are suggested (“encourage”)
- Practice will help in using all elements, improving the inventories quality

Final Considerations (IV)

Technical elements that could improve the quality of GHG inventories in the framework of National Communications:

- Use of GPG 2000, in accordance of real possibilities, particularly:
 - *establishing key source categories and choosing, by use of decision trees, the appropriated methods for national circumstances*
 - *following recommendations on EFs, activity data and documentation*
 - *recalculating emissions and ensuring consistency of trends*
 - *calculating quantitatively uncertainties at source level*
 - *applying basic procedures of quality assurance and quality control*
- Try to obtain and prioritize resources for real key categories, and share results with experts of other countries

Final Considerations (V)

Main elements that could improve the quality of GHG inventories in the framework of National Communications:

- Financial support and resources for preparation of Second National Communications and GHG inventories coming from GEF or bilateral projects
- Continuity of technical teams conducting elaboration of GHG inventories and its periodic preparation in the framework of a national management system
- Use of the new Guidelines for preparation of National Communications contained in decision 17.CP/8 (all its elements: mandatory, recommended and suggested)

LAND-USE CHANGE AND FORESTRY SECTOR (LUCF)



LAND-USE CHANGE AND FORESTRY SECTOR (LUCF)

- GHG inventory in biological sectors such as LUCF is characterized by:
 - ☞ *methodological limitations*
 - ☞ *lack of data or low reliability of existing data*
 - ☞ *high uncertainty*
- The assistance to NAI Parties in preparing GHG inventories using the IPCC 1996GL, particularly in the context of UNFCCC decision 17/CP.8, focusing on:
 - ☞ *the need to shift to GPG2003 and higher tiers/methods to reduce uncertainty*
 - ☞ *overview of the tools and methods*
 - ☞ *review of AD and EF and options to reduce uncertainty*
 - ☞ *use of IPCC inventory software and emission factor database (EFDB)*

Problems Addressed and Approach

- Problems encountered by NAI experts in using IPCC 1996GL are reviewed and categorized into: methodological issues, AD and EF/RF
- Approach adopted includes:
 - ☞ *GPG2003 approach*
 - ☞ *Strategies for improvement in methodology, AD and EF*
 - ☞ *GPG2003 strategy for AD and EF/RF*
 - ☞ *Sources of data for AD and EF/RF, including EFDB*

Definition of Key Terms

- **LUCF (Land-Use Change and Forestry)** – Land use is the type of activity being carried out on a unit of land, such as forest land, cropland and grassland. The IPCC 1996GL refers to sources and sinks associated with GHG emissions/removals from human activities, which:
 - ☞ Change the way land is used (e.g., clearing of forest for agriculture, conversion of grassland to forest)
 - ☞ Affect the amount of biomass in existing biomass stocks (e.g., forest, village trees, savanna) and soil carbon stocks
- **LULUCF (Land Use, Land-Use Change and Forestry)** – This includes GHG emissions/removals resulting from managed land (involving no change in use, such as forest remaining forest land) and land-use changes (involving changes in land-use, such as grassland converted to forest land or forest land converted to cropland).

Definitions...

- **Source** – Any process or activity that releases a GHG (such as CO₂ and CH₄) into the atmosphere. A carbon pool can be a source of carbon to the atmosphere if less carbon is flowing into it than is flowing out of it.
- **Sink** – Any process, activity or mechanism that removes a GHG from the atmosphere. A given pool can be a sink for atmospheric carbon if during a given time interval more carbon is flowing into it than is flowing out of it.

Definitions...

- **Activity data** – Data on the magnitude of human activity, resulting in emissions/removals taking place during a given period of time (e.g., data on land area, management systems, lime and fertilizer use).
- **Emission factor** – A coefficient that relates the activity data to the amount of chemical compound, which is the source of later emissions. Emission/removal factors are often based on a sample of measurement data, averaged to develop a representative rate of emission or removal for a given activity level under a given set of operating conditions.
- **Removal factor** – Rate at which carbon is taken up from the atmosphere by a terrestrial system and sequestered in biomass and soil.

Contribution and Role of LUCF sector to NAI GHG emissions

- Examination of National Communications (examples) – Argentina, Indonesia and Zimbabwe for 1994
- GHG inventories show that LUCF sector has a significant impact on national net CO₂ equivalent emissions in developing countries
- Could be a significant source *or* sink of CO₂
- LUCF sector is a net sink for Argentina and Zimbabwe
- Net source for Indonesia, which experienced forest land conversion of over one Mha
- Inclusion of LUCF sector in the inventory had the following impact on GHG emissions:
 - ☞ **Argentina:** Emissions of 119 Tg CO₂ when LUCF excluded, but 84 TgCO₂ when LUCF included
 - ☞ **Zimbabwe:** Source of 17 Tg CO₂ when LUCF excluded, but a net sink of 45 TgCO₂ when LUCF included
 - ☞ **Indonesia:** Emissions of 189 Tg CO₂ when LUCF excluded, but 344 Tg CO₂ when LUCF included.

Default Categories in IPCC 1996GL

5A. *Changes in forest and other woody biomass stocks due to*

- ☞ commercial management*
- ☞ harvest of industrial roundwood (logs) and fuelwood*
- ☞ establishment and operation of forest plantations*
- ☞ planting of trees in urban, village and non-forest locations*

5B. *Forest and grassland conversion*

- ☞ the conversion of forests and grassland to pasture, cropland etc. can significantly change C-stocks in vegetation and soil*

5C. *Abandonment of cropland, pasture, plantation forests, or other managed lands*

5D. *CO₂ emissions and removals from soils*

- ☞ cultivation of mineral soils*
- ☞ cultivation of organic soils*
- ☞ liming of agricultural soils*

GPG2003 LULUCF

Land-use Categories and Methods

- GPG2003 adopted two major advances over IPCC 1996GL, namely:
 - ☞ *Three hierarchical tiers of methods*
 - ❖ they range from use of default data and simple equations to use of country-specific data and models to accommodate national circumstances
 - ☞ *Land-use-category-based approach for organizing methodologies*
- **land-use categories:** Adopted six land categories to ensure consistent representation, covering all geographic areas of a country.
 - ☞ *Forest land, cropland, grassland, wetland, settlements and others*
- Each land-use category is further disaggregated to reflect the past and the current land use
 - ☞ *Forest land remaining forest land*
 - ☞ *Lands converted to forest land*

CO₂ Pools, Non-CO₂ Gases and Sources of Non-CO₂ Gases

- CO₂ and non-CO₂ trace gases
- CO₂ emissions and removal are estimated for all the C-pools namely:
 - ☞ *Above-ground biomass*
 - ☞ *Below-ground biomass*
 - ☞ *Soil carbon*
 - ☞ *Dead organic matter and woody litter*
- Non-CO₂ gases estimated include:
 - ☞ *CH₄, N₂O, CO and NO_x*
- Sources of non-CO₂ gases:
 - ☞ *N₂O and CH₄ from forest fires*
 - ☞ *N₂O from managed (fertilized) forests*
 - ☞ *N₂O from drainage of forest soils*
 - ☞ *N₂O and CH₄ from managed wetland*
 - ☞ *Soil emissions of N₂O from land-use conversion*

Broad Approach and Steps in Adopting GPG2003 LULUCF

- Accounts for all land-use categories and sub-categories, all carbon pools and non-CO₂ gases, depending on key source/sink category analysis
- Select nationally adopted land-use classification system (categories and sub-categories) for inventory estimation. Each land category is further subdivided into:
 - ☞ *land remaining in the same category (e.g. forest land remaining forest land)*
 - ☞ *other land category converted to this land category (e.g. grassland converted to forest land)*
- Select appropriate land classification system most relevant to country
- Conduct key source/sink category analysis to identify the key:
 - ☞ *land categories and sub-categories*
 - ☞ *non-CO₂ gases*
 - ☞ *carbon pools*

Steps to shift to GPG...

- Select appropriate tier level for key land categories and sub-categories, non-CO₂ gases and carbon pools, based on key category analysis as well as resources available for the inventory process
- Assemble required AD, depending on tier selected, from regional, national and global databases
- Collect EF/RF, depending on tier selected, from regional, national and global databases, forest inventories, national greenhouse gas inventory studies, field experiments and surveys and use of EFDB
- Select method of estimation (equations), based on tier level selected, quantify emissions/removals for each land-use category, carbon pool and non-CO₂ gas. Adopt default worksheet provided in GPG2003
- Estimate uncertainty
- Adopt QA/QC procedures and report results
- Report GHG emissions and removals using the reporting tables
- Document and archive all information used

Features of Land Category Based Approach – Forest Land

- Estimates carbon stock changes and GHG emissions/removals associated with changes in biomass and soil organic carbon on forest land and lands converted to forest land
 - ☞ *Forest land remaining forest*
 - ☞ *Land converted to forest*
- Provides methodology for five carbon pools
- Links biomass and soil carbon pools for the same land areas (at higher tiers)

Key Source/Sink Category Analysis

- “One that is prioritized within national inventory system because its estimate has significant influence on a country’s total inventory of direct GHGs in terms of absolute level of emissions (removals), the trends in emissions (or removals), or both”
 - ☞ *A land-use system or C-pool or non-CO₂ gas is significant if its contribution to GHG emissions/removals is >25%–30% of overall national inventory or overall LUCF sector inventory.*
- The term key category is used to represent both sources and sinks
- Key category analysis helps a country to achieve highest possible levels of certainty while using the limited resources available for the inventory process efficiently

Key Source/Sink Category Analysis GPG2003 Approach

- GPG2003 assists Parties in identifying the key:
 - ☞ *land categories (e.g. forest land, cropland, etc.)*
 - ☞ *gases (CO_2 , CH_4 and N_2O)*
 - ☞ *carbon pools (living biomass, dead organic matter and soil organic carbon)*
- The decision trees given in GPG2003 could be adopted
 - ☞ Decision trees at two levels of disaggregation
 - ❖ *Land remaining in the same land-use category (e.g. forest land remaining forest land)*
 - ❖ *Land converted to another land-use category (e.g. grassland converted to forest)*

Tier Structure: *Selection and Criteria*

- GPG2003 provides users with three methodological tiers for estimating GHG emissions/removal for each source.
- The three tiers defined in GPG2003 nearly correspond to the three levels of complexity given in IPCC 1996GL (not referred to as ‘tiers’)
- Tiers correspond to a progression from use of simple equations or methods with default data to country-specific data in more complex national systems
- Tiers implicitly progress from least to greatest levels of certainty in estimates as a function of:
 - ☞ *Methodological complexity*
 - ☞ *Regional specificity of model parameters*
 - ☞ *Spatial resolution and extent of activity data*

Combination of Tiers

- NAI experts could adopt multiple tiers in the GHG inventory for LULUCF sector:
 - ☞ *for different land-use categories*
 - ☞ *within a given land-use category for different carbon pools*
 - ☞ *within a carbon pool, for activity data and emission factor*

Adopt higher tiers for key categories and wherever possible use country-specific, climatic region-specific emission/removal factors

Comparison Between IPCC 1996GL and GPG2003

GPG2003	IPCC 1996GL
i) Land category based approach covering forest land, cropland, grassland, wetland, settlement and others	i) Approach based on four categories namely 5A to 5D (refer to Section 5.1) All land categories not included such as coffee, tea, coconut etc. Lack of clarity on agro-forestry
ii) These land categories are further sub divided into; <ul style="list-style-type: none"> • land remaining in the same use category 1. other land converted to this land category 	ii) Forest and grassland categories defined in 5A and 5B
iii) Methods given for all carbon pools; AGB, BGB, dead organic matter and soil carbon and all non-CO ₂ gases	iii) Methods provided mainly for aboveground biomass and soil carbon. <ol style="list-style-type: none"> 2. Assumes as a default that changes in carbon stocks in dead organic matter pools are not significant and can be assumed to be zero, i.e. inputs balance losses. 3. Similarly, belowground biomass increment or changes are generally assumed to be zero
iv) Key source/sink category analysis provided for selecting significant <ul style="list-style-type: none"> • land categories • sub-land categories • C-pools • CO₂ and non-CO₂ gases 	iv) Key source/sink category analysis not provided
v) Three tier structure presented for choice of methods, Activity Data and Emission Factors	v) Three tier structure approach presented but its application to choice of methods, AD and EF not provided
vi) Biomass and soil carbon pools linked	vi) Changes in stock of biomass and soil carbon in a given vegetation or forest type not linked

Key Activity Data Required for GPG2003 and IPCC 1996GL

GPG2003	IPCC 1996GL
<p>FOREST LAND</p> <p>i) Area of forest land remaining forest land</p> <ul style="list-style-type: none"> • Disaggregation according to climatic region, vegetation type, species, management system, age etc. <p>ii) Area of other land category converted to forest land</p> <ul style="list-style-type: none"> • Disaggregation as mentioned above <p>iii) Forest area affected by disturbances</p> <p>iv) Forest area undergoing transition from state (i) to (j)</p> <p>v) Area of forest burnt</p> <p>vi) Total afforested land derived from cropland/grassland</p> <p>vii) Area of land converted to forest land through</p> <ul style="list-style-type: none"> • natural regeneration • establishment of plantations 	<p>Category 5A to 5D</p> <p>i) Area of plantation/forests</p> <p>ii) Area converted annually</p> <p>iii) Average area converted (10-year average)</p> <p>iv) Area abandoned and regenerating</p> <ul style="list-style-type: none"> • 20-years prior to year of inventory • 20-100 years prior to the year of inventory <p>v) Area under different land use/management systems and soil type</p> <ul style="list-style-type: none"> • during year-t (inventory year) • 20-years prior to year-t <p>vi) Area under managed organic soils</p>
<p>CROPLAND, GRASSLAND, WETLAND ETC.</p> <ul style="list-style-type: none"> • <i>Similar categorization as above</i> 	

Key Emission Factors Required for GPG2003 and IPCC 1996GL

Average annual net increment in volume suitable for industrial processing	Annual biomass transfer into deadwood
Biomass expansion factor (BEF) for conversion of annual net increment (including bark) to above ground tree biomass increment	Annual biomass transfer out of deadwood
Root:shoot ratio appropriate to increment	Litter stock under different management systems
Biomass expansion factor (BEF) for converting volumes of extracted roundwood to total aboveground biomass (including bark)	Soil organic carbon in different management systems
Mortality rate in naturally and artificially regenerated forest	Mass of biomass fuel present in area subjected to burning

Number of emission factors common to both

- Above-ground biomass growth rate, biomass density
- Above-ground biomass stock, soil carbon density
- Fraction of biomass left to decay

Rationale for Adopting GPG2003

- **Addresses most of the methodological limitations and inadequacies of IPCC 1996GL**
- **Adopts key source/sink category analysis, which enables dedication of limited inventory resources to key source/sink categories, CO₂ pools and non-CO₂ gases**
- **Enables estimation of carbon stock changes and non-CO₂ emissions for all the relevant geographic area**
- **Accounts for all the five carbon pools**
- **Ensures consistent representation of land for long-term periodic inventories**
- **Reduces uncertainty in GHG estimates**

Reporting of GHG Inventory in the LUCF Sector – IPCC 1996GL

LUCF categories	CO ₂ emissions	CO ₂ removal/uptake	CH ₄	N ₂ O	CO	NO _x
5A. Changes in forest and other woody biomass stocks						
5B. Forest and grassland conversion						
5C. Abandonment of croplands, pastures, plantation forests, or other managed lands						
5D. CO ₂ emissions and removals from soils						
5E. Others						
TOTAL						

Reporting of GHG Inventory in the LUCF Sector – GPG2003

Greenhouse gas source and sink categories	IPCC guidelines	Net CO ₂ emissions / removals ⁽¹⁾	CH ₄	N ₂ O	NO _x	CO
		(Gg)				
5. Total Land-Use Categories						
5.A. Forest Land						
5.A.1. Forest Land remaining Forest Land	5A					
5.A.2. Land converted to Forest Land	5A, 5C, 5D					
5.B. Cropland						
5.B.1. Cropland remaining Cropland	5A, 5D					
5.B.2. Land converted to Cropland	5B, 5D					
5.C. Grassland						
5.C.1. Grassland remaining Grassland	5A, 5D					
5.C.2. Land converted to Grassland	5C, 5D					
5.D. Wetlands ⁽²⁾						
5.D.1. Wetlands remaining Wetlands	5A, 5E					
5.D.2. Land converted to Wetlands	5B, 5E					
5.E. Settlements ⁽²⁾						
5.E.1. Settlements remaining Settlements	5A					
5.E.2. Land converted to Settlements	5B, 5E					
5.F. Other Land ⁽²⁾						
5.F.1. Other Land remaining Other Land	5A					
5.F.2. Land converted to Other Land	5B, 5E					
5.G. Other (<i>please specify</i>) ⁽²⁾						
<i>Harvested Wood Products ⁽²⁾</i>						

Methodological Issues/Problems in GHG Inventory Using IPCC 1996GL

- *Compatibility of IPCC 1996GL land categories to national classification*
- *High uncertainty of inventory, AD and EF*
- *Lack of disaggregated data, particularly on vegetation types*
- *Lack of clarity for reporting estimates of emissions/removal in managed natural forest*
- *Lack of consistency in estimating/reporting total biomass or only above-ground biomass*
- *Lack of methods for below-ground biomass and for incorporating non-forest areas, such as coffee, tea, coconut, cashew nut*
- *Difficulty in differentiating managed (anthropogenically impacted) and natural forests*
- *Ambiguity in terminology, e.g. forest, afforestation, reforestation, managed forest*
- *Complexity of the methodology*



Problems Relevant to Activity Data and Emission Factors

GPG2003 Approach and Suggested Improvements

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GPG2003 Approach

- To minimize the uncertainty involved in inventory estimation originating from activity data and emission factors, the GPG2003 has provided multiple approaches.
 - ☞ *Key source/sink category analysis enables focusing of inventory efforts on the identified key source/sink categories, incorporating AD and EF*
 - ☞ *Three-tier approach for choice of AD and EF*
 - ☞ *Additional default values for emission and removal factors*
 - ☞ *Provision of improved sources of data, including EFDB*

Improvements for the Future

- Non annex-I Parties may have to:
 - ☞ Initiate dedicated inventory programs
 - ☞ Provide infrastructural and technical support for sustained inventory process
- This may involve:
 - ☞ Organizing periodic forest inventories
 - ☞ Satellite or remote-sensing-based land-use maps
 - ☞ Development of nationally relevant emission/removal factors
- Likely that many countries lack resources needed to initiate satellite-based monitoring
 - ☞ Obtain satellite maps from institutions such as FAO, UNEP and NASA and undertake ground truthing

Combining Tiers

- Inventory experts could adopt different tiers for different activity data
 - ☞ Party could use Tier 2 for activity data on area of forest/plantations, while using Tier 1 for commercial harvest and traditional fuelwood with data from FAO Yearbook of Forest Products
- Inventory experts could use different tiers for activity data and emission factors
 - ☞ Tier 2 for area of forest/plantations (AD) and Tier 1 for annual growth rate of above-ground biomass (EF)

Emission/Removal Factors

- The key emission/removal factors include:
 - ☞ *annual biomass growth rate, carbon fraction of dry matter, biomass expansion ratio*
- Biomass Expansion Ratios (BERs) as given in IPCC 1996GL are required to convert commercial roundwood harvested biomass (in m³) to total above-ground biomass (in tonnes)
- Similarly, AGB:BGB ratio is required to estimate BGB using data on AGB and the conversion ratio, according to GPG2003.
- Combining tiers – Inventory experts could adopt different tiers for different emission factors

Approach to Addressing Issues Relating to Emission/Removal Factors

Emission/removal factor	Tier 1	Tier 2	Tier 3
Annual biomass growth rate	<ul style="list-style-type: none"> - Default values of average annual biomass growth rate to be used for each forest / plantation category from global databases - <i>Verify, validate and update international data sources</i> 	<ul style="list-style-type: none"> - Use country-specific data available for as many forest/plantation categories - Use default data if country-specific data is not available for a given forest/plantation category 	<ul style="list-style-type: none"> - Use annual increment data from detailed periodic forest inventory/monitoring system - Species-specific allometric biomass functions could also be used
Carbon fraction of dry matter	<ul style="list-style-type: none"> - Use default data 	<ul style="list-style-type: none"> - Use default data, if forest species-specific data are not available 	<ul style="list-style-type: none"> - Use forest species-specific carbon fraction data obtained from laboratory estimations
Biomass expansion ratio (BER)	<ul style="list-style-type: none"> - Use default BER to convert commercial harvest data to total aboveground biomass removed in commercial harvest - BER requires conversion from m³ to tons and expansion ratio to convert commercial harvest data to total biomass removed 	<ul style="list-style-type: none"> - Inventory experts encouraged to develop country-specific BERs for different plantation / forest categories - Default values to be used in the absence of national data 	<ul style="list-style-type: none"> - Estimate BER values at species level - BERs for biomass increment, growing stock and harvest differ for a given species or a stand, requiring separate estimation

Short-term Strategy for Improving AGR Values

- Disaggregate the land use, forest or vegetation types occurring in the country at as fine a level as possible along the following lines or using other more nationally relevant stratification:
 - ☞ Different forest types / vegetation types / plantations
 - ☞ Latitude: tropical, temperate, boreal
 - ☞ Rainfall zone (mm/yr): humid (>2000), semiarid (500-1000), arid (<500)
 - ☞ Age of the stand: 0-5 yr, 5 to 10 yr, 10-20 yr, > 20yr
 - ☞ Management system: naturally regenerated or planted
 - ☞ Other category
- Allocate area of different forest types/plantations in the country, using forest map, rainfall zone map, soil map and other statistical information

Uncertainty Estimation and Reduction

- The good practice approach requires that estimates of GHG inventories be accurate
 - ☞ *They should neither be over- nor underestimated as far as can be judged*
- Causes of uncertainty could include:
 - ☞ *unidentified sources and sinks*
 - ☞ *lack of data*
 - ☞ *quality of data*
 - ☞ *lack of transparency*

Conclusions and Strategy for the Future

- NAI experts and compilation and synthesis reports by UNFCCC have identified a number of issues and problems in using IPCC 1996GL, including:
 - ☞ Lack of clarity in the methods and inadequacies of the methods
 - ☞ Lack of AD and EF
 - ☞ Low quality or reliability of AD and EF
 - ☞ High uncertainty of AD and EF, leading to uncertainty in inventory estimates
 - ☞ Non-suitability

GPG2003 Approach

- GPG2003 meant to overcome some of the methodological issues/problems identified in using IPCC 1996GL
- Suggests methods to reduce uncertainty
- Suggests an improved land category and full carbon (and non-CO₂ gases) estimation based approach and methods
- Adoption of GPG2003 approach will lead to:
 - ☞ *full and consistent representation, consideration and reporting of all land categories*
 - ☞ *full carbon (all 5 C-pools) estimation*
 - ☞ *reduced uncertainty*
 - ☞ *efficient use of limited inventory resources*

Background Resources

- Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories
 - ☞ <http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.htm>
- GPG2000 – Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories
 - ☞ <http://www.ipcc-nggip.iges.or.jp/public/gp/english/>
- GPG2003 – Good Practice Guidance for Land Use, Land-Use Change and Forestry
 - ☞ <http://www.ipcc-nggip.iges.or.jp/public/gp/landuse/gp/landuse.htm>
- EFDB – Emissions Factor Database
 - ☞ <http://www.ipcc-nggip.iges.or.jp/EFDB>
- IPCC Inventory Software – Revised 1996 IPCC Guidelines; Software for the Workbook
 - ☞ <http://www.ipcc-nggip.iges.or.jp/public/gl/software.htm>

IPCC Inventory Software

- Provides a Microsoft Excel based approach where AD and EF/RF data can be input to obtain net annual carbon uptake/release
- The key features or limitations in using the software are:
 - ☞ The names or type of forest/plantation category in a country may be different from the categories defined in the IPCC software
 - ☞ The IPCC software can be changed to nationally relevant categories (e.g. Acacia spp. can be changed to other spp.)
 - ☞ Names of categories, used in the column, are not included in the calculation procedure of the worksheets, and thus can be easily changed
 - ☞ Forest/plantation categories: Option exists for 18 categories, which is a limitation if a country has more than 18 categories
 - ☞ If the number of forest/plantation categories is more than provided
 - ❖ Option 1: Insert additional rows only if the inventory expert has capacity to modify the 'macros'
 - ❖ Option 2: Merge smaller or homogeneous categories such that the total number of rows (or categories) is not >18.

LUCF Status – EFDB (2004 Aug.)

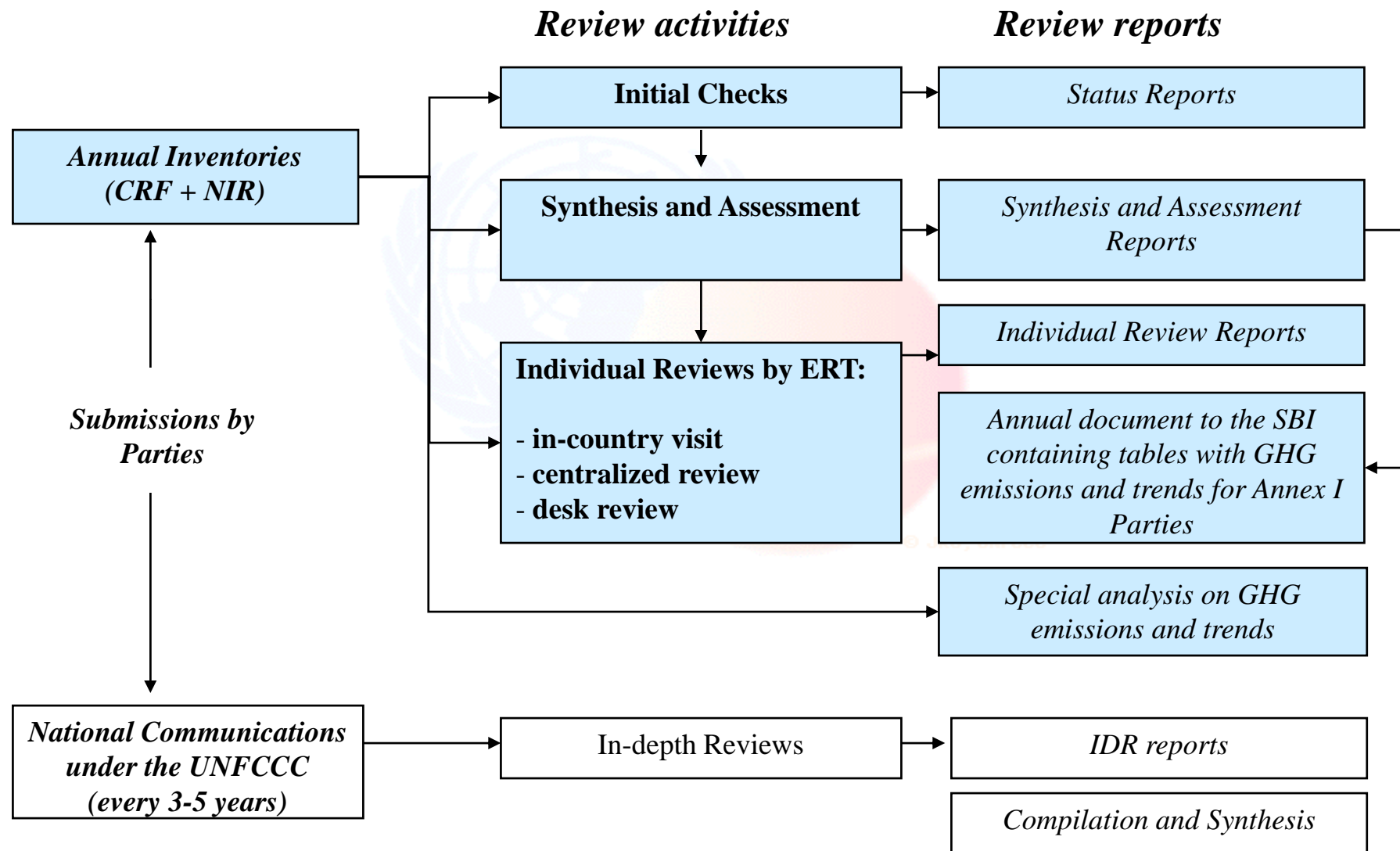
- The EFDB is an emerging database, initiated in 2002
- EFDB expects all experts to contribute to the database
- Currently, limited information for LUCF sector emission factors.
- In future, with contribution from experts around the world, EFDB is likely to become a reliable source of data for emission/removal factors for GHG inventory

IPCC 1996GL category	Emission factor records
Changes in Forest and Other Woody Biomass Stocks (5A)	34
Forest and Grassland Conversion (5B)	589
Abandonment of Managed Lands (5C)	0
CO ₂ Emissions and Removals from Soil (5D)	78
Other (please specify) (5E)	15
Total	716

Thank you



Review process of annual GHG inventories under the Convention



Materials and result of the review

Submissions:
NIR + CRF + references

Results from previous stages:

1. *Status reports*
2. *S&A report*
3. *Compilation of review findings*

Other materials to support review process:

- *UNFCCC guidelines*
- *IPCC guidelines*
- *IPCC good practice guidance*

Report template

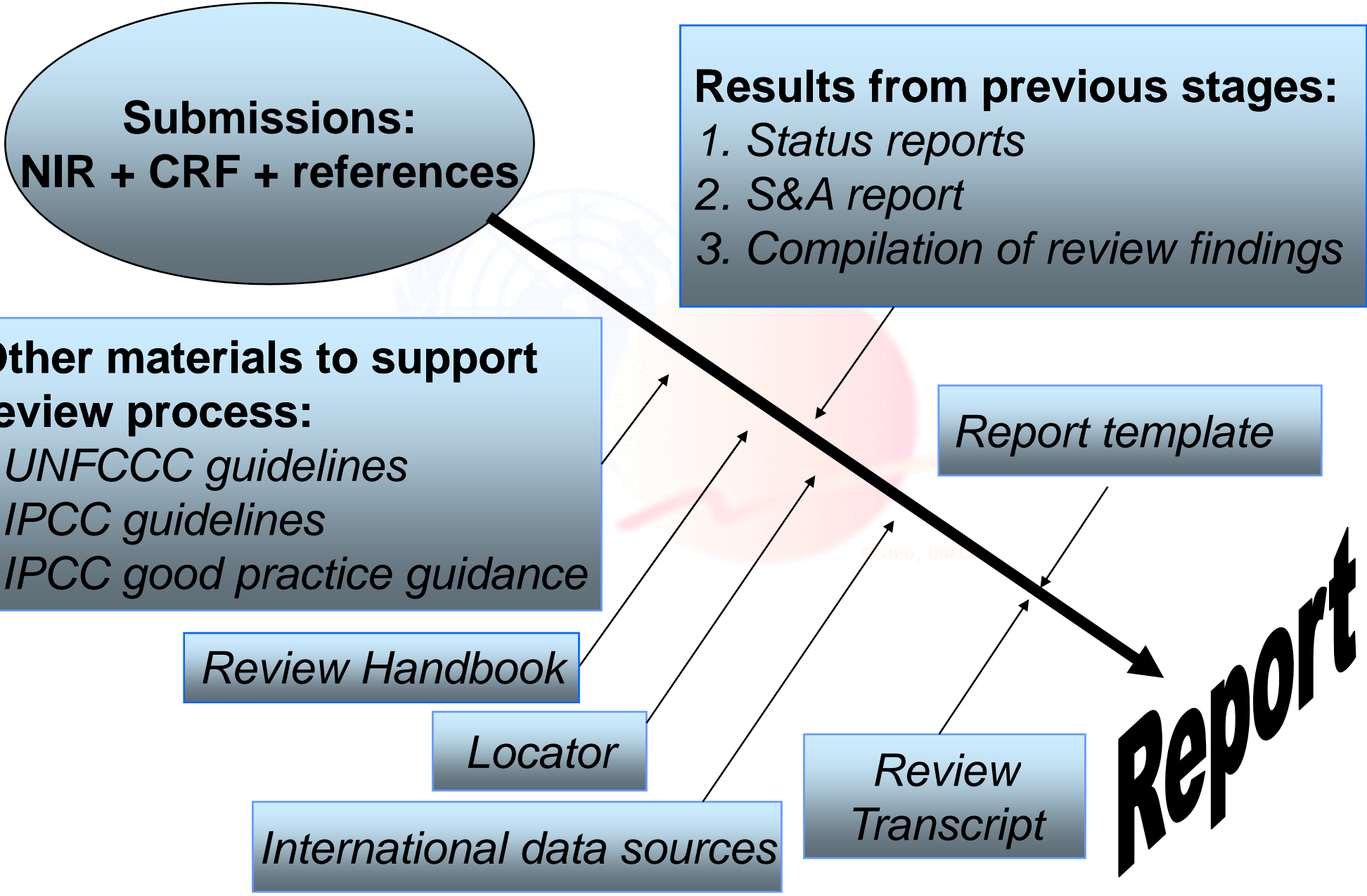
Review Handbook

Locator

International data sources

Review Transcript

Report



Reporting Requirements – CRF for LULUCF

