Proceedings of the training workshop on the National System for Greenhouse Gas Inventory in the context of REDD+

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Acronyms

AFOLU	Agriculture, Forestry and Other Land Use
ALU	Agriculture and Land Use software
CbC	Category-by-Category description
CBERS	China-Brazil Earth Resources Satellite
CDM	Clean Development Mechanism
CfRN	Coalition for Rainforest Nations
COP	Conference of the Parties
$CO2_e$	Carbon dioxide Equivalent
CSE	Central Database on Emission
DMHCC	Department of Meteorology, Hydrology and Climate Change
DNA	Designated National Authority
EF	Emission Factor
FAO	Food and Agriculture Organization of the United Nations
FUNCATE	Foundation for Science, Application and Space Technologies
GEF	Global Environment Facility
GHG	Greenhouse Gas
GIZ	German Agency for International Cooperation
GPG	Good Practice Guidance
GWP	Global Warming Potential
IA	Institutional Arrangement
INE	National Institute of Ecology - Mexico
INEGI	National Institute of Statistics and Geography - Mexico
INPE	National Institute for Space Research - Brazil
IPCC	Intergovermental Panel on Climate Change
IPPU	Industrial Process and Product Use
ISO	International Organisation for Standardisation
IT	Information Technology
KCA	Key Category Analysis
KP	Kyoto Protocol
LCA	Long-term Cooperative Action
LUCF	Land Use Change and Forestry
LULUCF	Land Use, Land Use Change and Forestry
MoU	Memorandum of Understanding
MoNRE	Ministry of National Resources and Environment - Vietnam
MRV	Measuring, Reporting and Verification
NAMAs	Nationally Appropriate Mitigation Actions
NFI	National Forest Inventory
NGOs	Non-governmental Organisations
NIIP	National Inventory Improvement Plan
NIS	National Inventory System
OECD	Organisation for Economic Co-operation and Development
QA/QC	Quality assurance/Quality control
QSE	Quality system on Emission
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
SEMARNAT	Secretary of Environment and Natural Resources - Mexico
SNC	Second National Communication
TCCCA	Transparency, Consistency, Comparability, Completeness and Accuracy
UN	United Nations
UNDP	United Nations Development Programme
US EPA	United States Environmental Protection Agency
UNFCCC	United Nations Framework Convention on Climate Change

1. Introduction

The Earth Summit in Rio de Janeiro (1992), was a major breakthrough in the United Nations (UN) negotiations on economic development; it aimed at halting the loss of irreplaceable natural resources and pollution of the planet, while ensuring social and economical growth. The resulting Summit message called for a transformation of our attitudes and behavior towards sustainability. Also, it reflected the complexity of the problems we are facing: the rising needs to combat poverty and excessive consumption by affluent populations has amplified the pressure on the environment. In response, governments recognised the need to redirect international and national plans as well as policies in order to ensure that all economic decisions fully take into account any environmental impacts. Such impacts include modification of environmental variables, as the climate, and/or the consumption of natural resources and the impact on their rate of renewal. Moreover, the outcome of the Summit has made sustainability a guiding principle for business and governments alike. All subsequent UN conferences should be focused on examining the relationship between human rights, population, social development, women, and human settlements and environment, and on the need for promoting and ensuring sustainable development.

One of the consequences of the Summit was the establishment of the United Nations Framework Convention on Climate Change (UNFCCC) [1]. With 194 Parties, the UNFCCC enjoys nearly universal membership. Its ultimate objective is to achieve stabilisation of greenhouse gas (GHG) concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a timeframe sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner. The UNFCCC sets an overall framework for intergovernmental efforts to tackle the challenge posed by climate change. It recognises that the climate system is a shared resource whose stability can be affected by industrial and other emissions of carbon dioxide and other GHGs. The UNFCCC entered into force on 21 March 1994 and has been presently ratified by 194 Parties. Under the UNFCCC, the governments shall: - Gather and share information on GHG emissions and removals, national policies and best practices; - Launch national strategies for addressing GHG net emissions and adapting to expected impacts, including the provision of financial and technological support to developing countries; - Cooperate in preparing for adaptation to the impacts of climate change.

The national GHG inventory is an instrument identified by the UNFCCC, in its Article 4, paragraph 1, for gathering and sharing information on GHG fluxes. The purposes of the GHG inventory are: to understand national trends in anthropogenic emissions by sources and removals by sinks and to estimate the global GHG emissions balance [2]. Annual balances of national net GHG emissions due to human activities in the national GHG inventory are expressed in tons of carbon dioxide equivalent (CO2e) [3]. To produce the national GHG inventory regularly, the Party shall establish a set of functions for its planning, preparation and management and maintain them over time. Under the Kyoto Protocol (KP) of the UNFCCC these functions have been formalised in a decision text [4] and altogether constitute the national system for the GHG inventory to which

[1]UNFCCC,(2009) Essential background: the Convention, available at: http://unfccc.int/essential_background/convention/items/2627.php

[2]UNFCCC,(2006) Updated UNFCCC reporting guidelines on annual inventories following incorporation of the provisions of decision 14/CP.11,in Subsidiary Body for Scientific and Technological Advice 25th Session, 6- 14 November 2006. Nairobi

[3]UNFCCC, (2003) Decision 17/CP.8 Guidelines for the preparation of national communications from Parties not included in Annex I to the Convention, 8th Session of the Conference of the Parties, 23 October- 1 November 2002. New Delhi

[4]UNFCCC, (2005) Decision 19/CMP.1 Guidelines for national systems under Article 5, paragraph 1, of the Kyoto Protocol, in The Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol on its first session, 28 November- 10 December 2005. Montreal

Parties must conform.

1.1. Setting the context

The national GHG inventory is a relatively new tool compared to other instruments for inventorying the status of environmental resources, such as the national forest inventory (NFI). For example, Finland started developing NFI about 100 years ago and methods to inventory the forests have been continuously improved since then, with new statistics and technologies being incorporated. In comparison, the national GHG inventory remains in "a juvenile phase" since the Parties started conducting it about 20 years ago. Nonetheless, the number of users has been on the rise and the level of quality and completeness is advancing - an aspect witnessed and mirrored by the production of a series of Intergovernmental Panel on Climate Change (IPCC) Guidelines and Guidance. The data provided by the national GHG inventory is employed in various fields by: (1) the scientific community for developing climate models and assess the impact of human activities on the GHG concentrations in the atmosphere; (2) the business community, the public, and other stakeholders to better understand the sources and trends of their emissions and the sinks for their offsetting; and (3) policy makers to evaluate the impact of low carbon strategies and policies on the national GHG budget.

1.1.1. Current legal requirements for non-Annex I Parties

Article 4, paragraph 1, of the UNFCCC sets the legal obligation for all Parties - taking into account their common but differentiated responsibilities and their specific national and regional development priorities, objectives and circumstances - to "develop, periodically update, publish and make available to the Conference of the Parties (COP), in accordance with Article 12[5] , national inventories of anthropogenic emissions by sources and removals by sinks of all GHG not controlled by the Montreal Protocol[6] , using comparable methodologies to be agreed upon by the COP." In non-Annex I Parties, the national GHG inventory is a portion of the national communication; it follows the timing of the national communication and the preparation and delivering depends on the availability of resources - both human and financial - and on the arrangements put in place for the national communication. Consequently, the constraints of the national communication preparation as well affect the national GHG inventory development. As of January 2011, of the 153 non-Annex I Parties, 137 Parties have submitted their initial national communications, 24 Parties their second national communications and one Party their third and fourth national communications. In addition, 92 non-Annex I Parties were engaged in the preparation of their second national communications.

A recent report of the Consultative Group of Experts on National Communications [7] identifies several constraints for the national communication of non-Annex I Parties, for example: insufficient skills of national experts for the preparation of the GHG inventory; lack of capacity-building activities for institution level rather than individual level; and shortage of data availability and access. Moreover, the Parties have limited financial resources, causing their preparation of the national GHG inventory to follow strictly the delivery of funds from the Global Environment Facility

[5]Article 12 of UNFCCC rules the preparation and submission of the National Communication

[6]The Montreal Protocol on Substances that Deplete the Ozone Layer regulates many radiatively powerful GHGs for the primary purpose of lowering stratospheric chlorine and bromine concentrations. These GHG include the CFCs, HCFCs, chlorocarbons, bromocarbons and halons.

[7]UNFCCC, (2010) Progress report on the work of the Consultative Group of Experts on National Communications from Parties not included in Annex I to the Convention, in Subsidiary Body for Implementation 33rd Session, 30 November- 4 December 2010. Cancun

(GEF). Currently [8], the non-Annex I Parties are requested to use the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories for the preparation of the national GHG inventory, but are also encouraged to use the IPCC Good Practice Guidance (GPG)[9].

1.1.2. Expected requirements under the LCA agreement

The Cancun Agreements [10], December 2010, include two important decisions regarding mitigation actions that will be implemented by non-Annex I Parties. Those Parties:
- will take Nationally Appropriate Mitigation Actions (NAMAs) to deviate their emissions relative to ̈business as usualëmissions in 2020; and
- should, collectively with Annex I Parties, aim to slow, halt and reverse forest cover and carbon loss by implementing REDD+ activities.

In accordance with the Cancun Agreements, Non-Annex I Parties should submit their national communications to the Conference of the Parties, in accordance with Article 12, paragraph 1, of the Convention every four years or in accordance with any further decisions on frequency by the Conference of the Parties taking into account a differentiated timetable and the prompt provision of financial resources to cover the agreed full costs incurred by non-Annex I Parties in preparing their national communications. The national communications provide information to the COP on the ongoing and planned actions, adaptation and mitigation measures to climate change, sustainable development, financial and technological transfers and capacity building activities. The non-Annex I Parties - in keeping with their capabilities and the level of support provided for reporting - should also submit biennial update reports on the national GHG inventory with information on mitigation actions and needs and support received. This will allow for the assessment of results of the implemented mitigation actions. Additional flexibility is given to the least developed country Parties and Small Island Developing States.

With regards to REDD+ activities, the timing for reporting has not been established yet. However, the Cancun Agreement mentioned the need to ensure consistency with any guidance regarding measuring, reporting and verification (MRV) agreed for NAMAs. Both sections of the Cancun Agreement on NAMAs and REDD+ significantly change the legal requirements for reporting of the non-Annex I Parties to the UNFCCC. It is thus expected that the Parties will have to move from a system based on temporary arrangements, which delivers the national GHG inventory together with the national communication without any time constraint, to a permanent system, which deliver the national GHG inventory and the supplementary information related to NAMAs, and likely REDD+, every two years.

Broadly, the aim of NAMAs and REDD+ is to provide financial compensations for reduced net emissions. To be efficient, the financial compensation shall provide the appropriate incentive to the right people at the right time, making it worthwhile for them to change their current behavior and use of resources. To do so, a system for MRV emissions and removals related to implemented actions shall be set. The cornerstone of such a system is the national GHG inventory and its national system, which covers all anthropogenic emissions by sources and removals by sinks in order to assess the real impact of human activities. An incomplete inventory is likely to give misleading information on real impacts and on GHG fluxes that those impacts generated.

[8] UNFCCC,(2003) Decision 17/CP.8 Guidelines for the preparation of national communications from Parties not included in Annex I to the Convention, 8th Session of the Conference of the Parties, 23 October- 1 November 2002. New Delhi

[9] For electronic copy of the IPCC GPG, please visit: http://www.ipcc-nggip.iges.or.jp/public/index.html

[10] UNFCCC, (2010) Draft decision CP.16: Outcome of the work of the Ad Hoc Working Group on LCA under the Convention, available at: http://unfccc.int/documentation/decisions/items/3597.php?such=j&volltext=/CP.16#beg

1.1.3. Current legal requirements for Annex I Parties

Under the expected Long-term Cooperative Action (LCA) agreement non-Annex I Parties are going to move towards a regular reporting of GHG data, possibly every two years. Therefore it is worthwhile to have an overview of current legal requirements of the annual reporting of GHG data by Annex I Parties.

In accordance with Articles 4 and 12 of the UNFCCC, and the relevant decisions of the COP, Annex I Parties to the UNFCCC are requested to submit [11] annually the national GHG inventory of anthropogenic emissions by sources and removals by sinks of GHG not controlled by the Montreal Protocol. These inventories are subject to an independent technical review process, which may calculate the adjusted estimates in the following circumstances [12]: (1) when the estimates fail in being transparent; (2) when the lack of information inhibits the expert review team from assessing the completeness of emissions and removals in the category, the consistency of methods applied with the IPCC Guidelines and Guidance and the bias of the estimates. In addition, the Annex I Parties provide inventory data in summary format in their national communications under the UNFCCC [13].

Under the KP, the Annex I Parties are requested to set a national system in order to plan, prepare and manage their national GHG inventory. Such system includes institutional, legal and procedural arrangements made within a Party for estimating and reporting anthropogenic emissions by sources and removals by sinks of all GHG not controlled by the Montreal Protocol and for archiving inventory data and information while ensuring its quality. Any problem related to the proper functioning of the national system identified during the technical review may be formalised in a question of implementation, which may lead to the suspension by the enforcement branch of the compliance committee of a Party's eligibility to participate in the emissions trading.

For the preparation of the national GHG inventory, the Annex I Parties are currently requested to use the Revised 1996 IPCC Guidelines as elaborated by the IPCC GPG. However, under Agenda item 7 (d), the Subsidiary Body for Scientific and Technological Advice is considering the adoption of the 2006 IPCC Guidelines for National GHG Inventories for reporting from the inventory year 2013 onwards. Setting and maintaining a GHG Inventory and its national system is a continuous activity. All arrangements, procedures, methods, data and the consequent estimates are constantly improving and difficulties, failures, inefficiencies are addressed in an annual review process.

1.2. Objectives

Considering the future requirements for the national GHG inventory of non-Annex I Parties, a Training Workshop on the National System for the GHG Inventory was organised by Partner agencies and held in Rome at the Food and Agriculture Organisation of the United Nations (FAO) Headquarters from January 25 to 28, 2011. The objectives of the workshop were as follows:

- Present the current legal status of GHG Inventory for non-Annex I Parties and its relevance for REDD+ and NAMAs;
- Provide training on establishing and developing the national system for the GHG Inventory and

[11] UNFCCC, (2009) Annex I Greenhouse Gas Inventories,
available at: http://unfccc.int/national_reports/annex_i_ghg_inventories/items/2715.php

[12] UNFCCC, (2005) Decision 19/CMP.1 Guidelines for national systems under Article 5, paragraph 1, of the Kyoto Protocol, in The Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol on its first session, 28 November- 10 December 2005. Montreal

[13] For the submitted national communications of the Annex I Parties, available at:
http://unfccc.int/national_reports/annex_i_natcom/submitted_natcom/items/4903.php

a platform for the Parties to share experiences and knowledge;
- Identify the needs of the Parties in order to plan and coordinate further actions on capacity building, with the aim to: (1) promote the establishment of the national system for the GHG inventory where not yet in place; (2) strengthen the system where already existing; and (3) provide general suggestions to the Parties.

The objectives were therefore consistent with the final scope of the capacity building activities of the implementing agencies, which allow the non-Annex I Parties to fully benefit from mitigation actions and related mechanisms that will be implemented under the upcoming agreement on the LCA. As a follow up of the Workshop, the Proceedings are aimed at helping Parties and technical people involved in capacity building and assistance programmes to efficiently set up the national system for the GHG inventory.

The Workshop represented a joint effort of different agencies currently involved in three capacity building programmes, the UN-REDD Programme [14], CD-REDD II Programme [15] and the United States Environmental Protection Agency (EPA) Programme [16] implemented under the UNFCCC. Most examples provided during the workshop, as well as the questionnaire, were focused on agriculture, forestry and other land use (AFOLU) sector since the final scope of both UN-REDD and CD REDD II programmes is to support Parties to participate in the REDD+ mechanism. However, all information presented during the Workshop is fully applicable to the whole National GHG Inventory and to the system that Parties are required to establish and maintain for the timely preparation of a complete, comparable and accurate set of estimates of anthropogenic emissions by sources and removals by sinks.

2. Presentations

This section provides the main topics covered during the presentations given during the Workshop. The information is chronically ordered according to the presentation schedule.The slide number is provided on the side of the corresponding paragraphs. The presentation slides, the schedule as well as other supportive information can be found in the attached CD-Rom.

2.1. The national system for the GHG inventory

Dominique Revet

[14]The UN-REDD Programme is the UN collaborative initiative on reducing emissions from deforestation and forest degradation in developing countries. It aims to assist the countries in preparing and implementing the REDD+ strategies

[15]The CD-REDD II Programme (Capacity Development for forest-related GHG inventories) is a capacity building project financed by the International Climate Initiative (ICI) of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) on the basis of a decision adopted by the German Bundestag. CD-REDD II provides training activities on national GHG inventory for the AFOLU sector and a platform for communication among partner development agencies to coordinate capacity building activities. The project is implemented by GIZ jointly with CfRN and vTI

[16]The US EPA programme assists non-Annex I Parties in building GHG inventory capacity primarily via two complementary sets of tools: national system templates and targeted data collection strategies and software tools

Slide 3

The national system includes all institutional, legal and procedural arrangements made within a Party included in the Annex I to the UNFCCC that is also Party to the KP, referred to herewith as Annex I Party, for estimating anthropogenic emissions by sources and removals by sinks of all GHGs not controlled by the Montreal Protocol, and for reporting as well as archiving the inventory information. Under Article 5, paragraph 1 of the KP, the Annex I Parties are required to establish a national system.

Slide 4

According to the UNFCCC Guidelines for National System (Decision 19/CMP.1), a national system for the Annex I Parties has general and specific functions. General functions are: (1) to establish and maintain the institutional, legal and procedural arrangements to perform its functions; and (2) to prepare and report the national annual GHG inventories and supplementary information. Specific functions cover inventory planning, preparation and management. (1) Inventory planning involves designating a single national entity, allocating specific responsibilities in the inventory development process, elaborating an inventory quality assurance/quality control (QA/QC) plan, establishing the official approval and improving the quality of the GHG inventory data. (2) Inventory preparation involves data collection, preparing emission estimates and recalculations, identifying key categories, preparing uncertainty analysis and QA/QC and compiling data for reporting in accordance with the KP. (3) Inventory management includes archiving and providing review teams with access to the necessary information and requested clarifications. The functions of the national system are designed to achieve the following goals:

- to enable Annex I Parties to estimate anthropogenic GHG emissions by sources and removals by sinks, as required by the KP, and relevant related decisions, ensuring transparency, consistency, comparability, completeness and accuracy of the inventories (i.e. the TCCCA principle as defined by the IPCC);
- to ensure and improve the quality of the inventory and related activities;
- to assist Annex I Parties in meeting their commitments under the KP, in particular articles 3 and 7; and
- to facilitate the reviews of GHG inventory and complimentary information submitted under Article 7.

In order to fulfill these goals, the Annex I Parties have encountered some challenges that need to be further addressed, , these include:

- creating the institutional arrangements on a long-term basis by means of framework agreements or memorandum of understanding (MoU) and financial support;
- clearly specifying the role and responsibilities of the institutions involved in the GHG inventory preparation; - elaborating, implementing and documenting detailed QA/QC plans; and
- ensuring adequate resources for timely performance and sufficient coverage by the national system of the KP-LULUCF activities (activities referred to in Article 3, paragraphs 3 and 4, of the KP).

Slide 5-6

The experiences of the Annex I Parties in developing a national system reveal a number of suggestions for the strengthening of these national systems. Firstly, for the inventory planning, roles, responsibilities and collaboration between relevant organisations should be formalized as much as possible, potentially through the use of agreements or law. Secondly, the QA/QC activities, national inventory improvement plan (NIIP), archiving and documentation should be implemented in a timely manner. Thirdly, particular attention should be paid to capacity building in order to strengthen the skills of national experts. Lastly, financial resources should be secured to ensure regular and sufficient resources for its operation.

Slide 7

The future reporting requirement of the GHG inventories from non-Annex I Parties as agreed in the COP 16 is likely to be more frequent compared to their current reporting and the process of GEF financing adjustment corresponding to the change is underway. In order to prepare high quality national GHG inventories and to meet the future reporting demand, the development of institutional frameworks for GHG inventory preparation by non-Annex I Parties in the post-2012 is encouraged. The development and implementation of such frameworks in the post-2012 regime

could benefit from the experiences of Annex I Parties. The abovementioned suggestions should be considered and could be adapted to country-specific circumstances including levels of development, commitments and priorities.

2.2. The national GHG inventory

Simon Eggleston

The GHG inventory is a crucial instrument of understanding and addressing many environmental problems. Apart from meeting the obligation to the UNFCCC, it offers a range of benefits as the following: Slide 5-6

-**Create credible GHG emissions data:** There is a need for credible, consistent and comparable data in accordance to the MRV approach.

-**Support for making policy decisions:** Before any pollution problem can be efficiently controlled, there is a need for GHG inventory to identify the sources and quantify GHG emissions. The inventory thus helps develop cost-effective policy, monitor progress towards policy goals and inform the general public.

-**Provide scientific understanding:** GHG estimates are used as model input to understand the link between emissions, environmental effects and pollution as well as to project future emissions.

-**Improve national statistics:** The GHG inventory requires the collection of land-use data, which indicates where and how land-use is changing. The collected data collected then deepens understanding of local drivers of change, which can be used to address other issues beyond climate change.

-**Build technical capacity:** The skills developed and maintained in national GHG inventory can be applied at the local level to manage projects in other areas.

-**Identify mitigation alternatives:** The GHG inventory helps identify potential benefits and impacts of a project, thus proving useful in making project-funding decisions.

Under Article 4 of the UNFCCC, all Parties shall develop national inventories of anthropogenic emissions and removals of all GHG not controlled by the Montreal KP, using comparable methodologies. The methodologies refer to those produced by the IPCC. Annex I Parties shall use the Revised 1996 Guidelines [17]and Good Practice Guidelines (GPG) 2000 [18], and Land-use, Land-use Change and Forestry (LULUCF) [19] annually. Non-annex I Parties should use the Revised 1996 Guidelines and are encouraged to use the GPG 2000 and LULUCF when developing their national communications. The latest IPCC Guidelines (2006)[20] are under consideration by the UNFCCC. However some Annex I and non-Annex I Parties have already used the 2006 methods in whole or in part. Slide 7-9

The IPCC has played a significant role in developing guidelines for national GHG inventory. The Task Force on National GHG Inventory of the IPCC has produced guidelines for estimating Slide 10-16

[17]IPCC, (1997) IPCC Guidelines for National GHG Inventories

[18]IPCC, (2000) Good Practice Guidance and Uncertainty Management in National GHG Inventories

[19]IPCC, (2003) Good Practice Guidance for Land-Use, Land-Use Change and Forestry, available at: http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml#4

[20]IPCC, (2006) Guidelines for National GHG Inventories available at: http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml#4

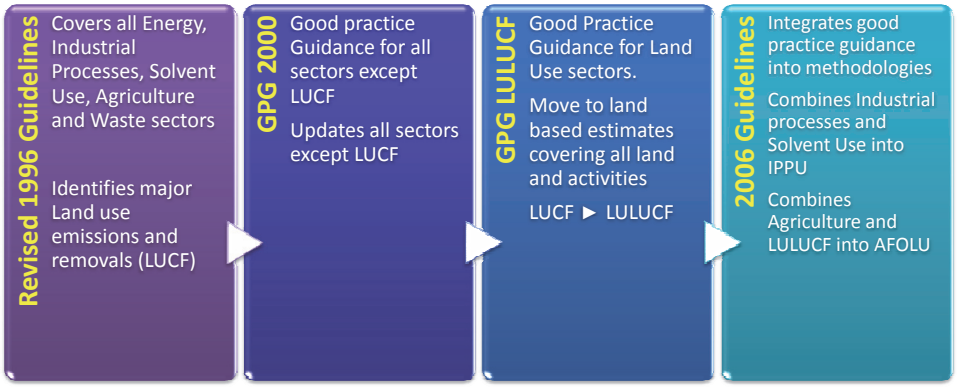


Fig. 1. Guidelines development and major changes

emissions and removals of GHG emissions, primarily by experts and authors, who are nominated by governments. The IPCC started developing Guidelines for estimating GHG emissions and removals before 1991. The first publication was issued in 1991 jointly by the OECD and the IPCC, and guideline development continued with the Revised 1996 Guidelines for national GHG inventories. Following the request from the UNFCCC, GPG 2000 and 2003 were produced. These publications address both technical methods for estimating emissions and removals as well as how to construct the GHG inventory. The Revised 1996 Guidelines and GPG 2000 and 2003 currentlie underlay the reporting to the UNFCCC. The process continued and by 2006 the latest IPCC Guidelines were published, which update all the earlier guidelines and integrate GPG into the guidelines.

Slide 17

It is worthwhile to mention the major changes that occurred throughout the improvement and development process of the Guidelines over the years (Figure 1). The Revised 1996 Guidelines identified only major land-use change emissions and removals and adopted a process-based approach, where a number of key processes were identified and methods were presented. The 2000 GPG address all the sectors except for land-use change and forestry (LUCF). In 2003, the GPG was extended to cover the LUCF sector. However, the approach to LUCF emissions and removals was changed to a land-based approach. The approach covers all land and activities that are considered anthropogenic. This led to the development of LULUCF sector. The 2006 Guidelines formed two new sectors: industrial process and product use (IPPU) and AFOLU. The new sectors were formed by combining two existing sectors in order to avoid double-counting and potential omissions. Comparing the new AFOLU sector with the earlier LULUCF sector, biomass burning sometimes causes concerns, as it is not exactly equivalent. This is because unlike the earlier guidelines, where only Savannah burning and open burning of agricultural waste were covered, in the 2006 Guidelines all biomass burning was covered and allocated to land types rather than agriculture.

Besides the IPCC Guidelines, the UNFCCC also provides Reporting Guidelines, which include the reporting table and structure of contents that extends to a number of chapter and appendices. Additional Guidelines by the UNFCCC are the Guidelines for reviewing the inventories. The objectives are to promote consistency in the review of national GHG inventory and to ensure that that the review processes are geared towards providing accurate and reliable information that can be trusted.

Slide 19-20

To estimate GHG emissions and removals, one has to consider the inventory scope, estimation methodologies and data needs. Firstly, the scope of national GHG inventory needs to be defined. The scope covers all anthropogenic emissions and removals within annual time series (Calendar year). All emissions within national boundaries are included with certain pragmatic rules (for example,

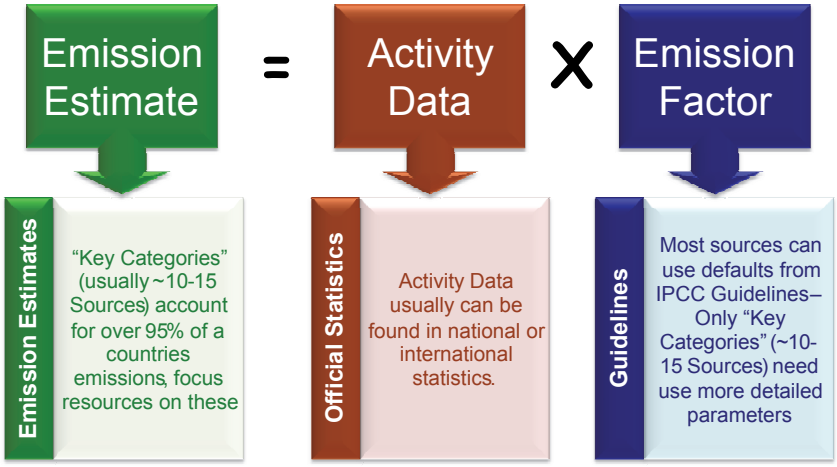


Fig. 2. Basic method for estimating emissions

international shipping and aviation are not covered whilst domestic shipping and aviation are). For LULUCF anthropogenic is defined as all emissions and removals occurring on managed land. The managed land is defined fairly broadly. It is not strictly the same as anthropogenic emissions yet is regarded as being the best approximation available that can be used on a global basis. Considerable research has been undertaken to see if this approximation can be refined in practice. Another definition, CO2e, is used to compare different gases with various climatic effects. For example, the IPCC Guidelines use the CO2e in key category analysis (KCA) and uncertainty analysis, where there is a need to compare different gases as well as in the IPPU sector for combinations of fluorinated gases. However the IPCC guidelines do not specify any values to convert mass emissions into CO2e. The COP has decided to use global warming potentials with a 100 years (GWP - 100) horizon from the IPCC's 2nd Assessment Report. Apart from the terminology, types of GHG to be included in the inventory should be identified.

Secondly, the estimation methods and sources of emission estimations should be identified. As it is not possible to measure all emissions and removals, estimates should be made based on parameters associated with emission rates, e.g. changes in carbon stocks give good estimates for emissions and removals from forestry. A general method for estimation can be followed. Emission estimate equals to a sum of activity data times emission factor (EF) (Figure 2). For key categories, it is recommended to use country-specific activity data and EFs. For the remaining sectors, the IPCC default EFs that are available in the guidelines can be applied. Activity data specific to each country should be found, which often appears in the national statistics. Slide 21-27

For land-use, there are two approaches to estimate emissions: difference between carbon stocks at different point of time and the sum of carbon stocks losses and gains (Figure 3). The former approach estimates emissions by identifying the changes of carbon stocks at the beginning and the end of the period. The latter approach estimates emissions by identifying the amount of losses through disturbances and harvest and gains through growth. Both approaches assume that emissions equals to total stock changes. Slide 28-30

Apart from these simple calculations, there are other sources of emission estimates: measured emissions and complex calculations. (1) The measured emission estimates are increasingly available due to the emission trading scheme requirements in some countries. However, using these estimates requires careful consideration, and compatibility with the unmeasured part of the inventory must be ensured otherwise inconsistencies may arise. (2) Estimations may also come from complex models that the Party developed (Tier 3 method). The complex calculations include many parameters, e.g.

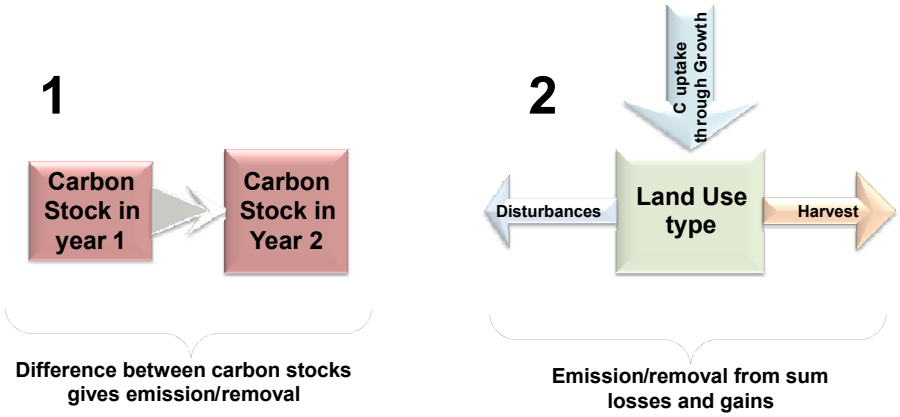


Fig. 3. IPCC estimation methods to measure carbon stock changes

livestock, land-use and landfills. Some emissions occur over a period of years after the actual action, such as landfills (solid waste disposal sites) and harvested wood products. However the Party needs to ensure that the complex models are compatible with the IPCC Guidelines.

Slide 31-32 Lastly, data needs should be addressed. Particularly for land-use, there is a range of data necessary for calculation. Various EFs and parameters such as conversion factors of carbon content of wood, above ground biomass to total biomass and growth rates are required. To alleviate the lack of data, the Guidelines provide default values for different regions and ecosystems. Nonetheless it should be noted that some country-specific data tend not to change annually. Therefore the Parties are encouraged to invest in finding country-specific data that are better suited to local circumstances. Such data may also be suitable for regional circumstances, where a group of countries share similar ecosystem. Collaboration within the region for data could hence be seen as a cost-effective alternative. For activity data e.g. areas of forests, areas converted, areas undergoing types of management and amounts harvested, such data changes on an annual basis so it is necessary to be monitored closely. The collection of activity data should be conducted with the aim for representative, reliable and consistent data over time. It could be done either from ground surveys, forest inventories or using satellite data.

Slide 34-37 GPG inventories are defined as "those that contain neither over-nor under-estimates so far as can be judged and in which uncertainties are reduced as far as is practical". The GPG inventories are transparent, consistent, complete, comparable and accurate (TCCCA principle) while taking into account the available resources. The inventories that comply with this should be well documented, assessed for uncertainties, subjected to QA/QC, make efficient use of resources and reduce uncertainties over time. After fulfilling the requirements, the inventories would be credible, reliable and useful. The GPG gives guidance on a number of functions that are all an integral part for producing national GHG inventories, namely: 1) QA/QC, 2) key categories, 3) uncertainty analysis, 4) recalculation and 5) documentation.

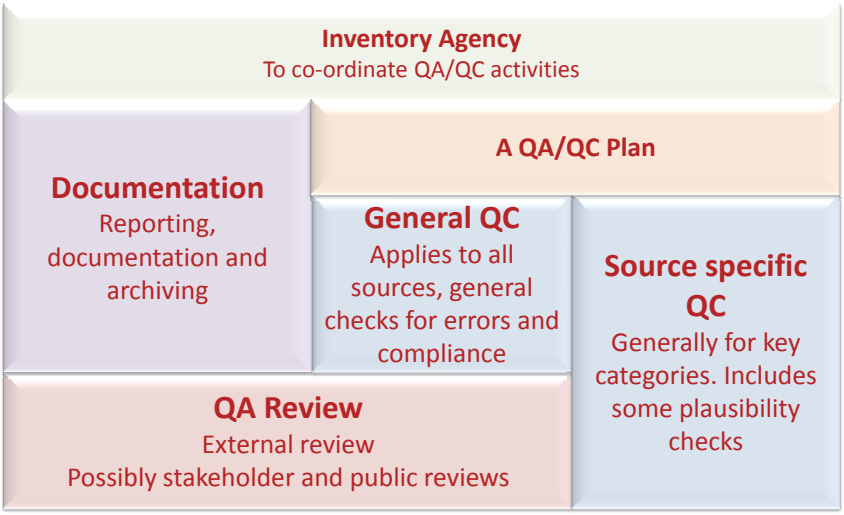


Fig. 4. Major elements of quality assurance and quality control

2.2.1. Quality Assurance and Quality Control

QA activities include a planned system of review procedures conducted by personnel which is not directly involved in the GHG inventory development process. The review could provide valuable feedback for the inventory. QC is a system of routine technical activities to measure and control the quality of the inventory as it is being developed. The QC system is designed to provide routine and consistent checks to ensure data integrity, correctness and completeness, identify and address errors and omissions, and document and archive inventory material and record all QC activities. Slide 38

Major elements of QA/QC are illustrated in Figure 4. General QC requires all sources to provide general checks for error and compliance. Source-specific QC, which includes plausibility checks, should be applied particularly to key categories. QA reviews could be conducted possibly by stakeholders and through public reviews. QA/QC plan should be prepared in order to provide a specific timeline for each activity to be followed. In conjunction with the plan, there should be an entity with responsibility to coordinate all involved entities to perform QA/QC activities as planned. Moreover the lead entity should also ensure that the performance of QA/QC activities is thorough. Slide 39

2.2.2. Methodological choice - key category analysis

Typically methods are divided into Tiers. Tier 1 methods are simple methods with default IPCC values. Tier 2 methods are similar to Tier 1 but with country-specific EF and other data. Tier 3 methods are more complex approaches, possibly models. The methodological choice is guided by KCA (Figure 5). Decision trees as provided in GPG 2000 and 2003 or 2006 Guidelines can be followed. Since key categories have the most significant impacts to the total emissions, they should be addressed by at least Tier 2 methods if possible in order to enhance accuracy of the estimates. Other reasons to use a higher tier approach may be the need for more detail for a particular sector, for example, the need to understand the abatement effect of a mitigation project. KCA needs to be Slide 40-42

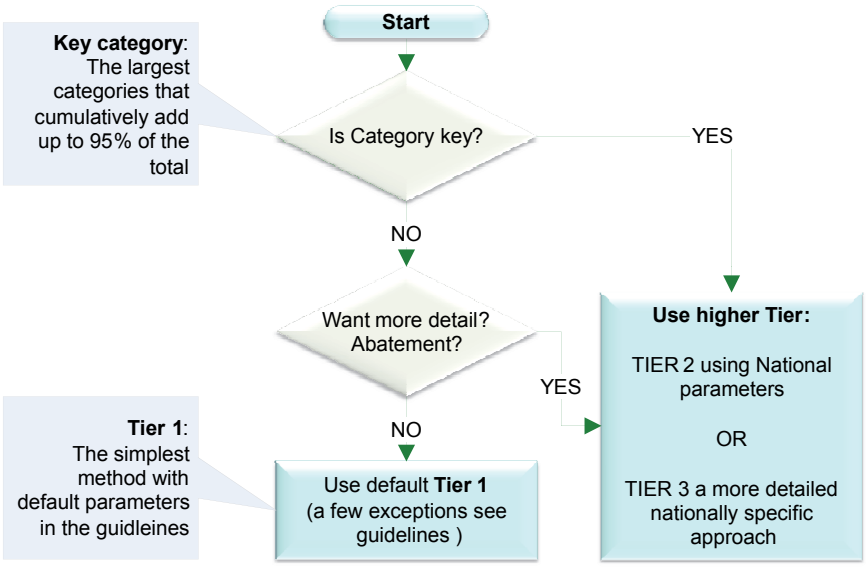


Fig. 5. Methodological choice and key categories

conducted with and without the LULUCF categories in order to correctly identify the key categories. Trend assessment can also identify additional key categories. Typically, the analysis identifies about 10-20 source categories as key.

2.2.3. Uncertainty analysis

Slide 43

Uncertainty analysis is another essential part of a GHG inventory. It helps prioritise efforts to improve accuracy and guide decisions on methodological choice. However it can be difficult or impossible to quantify and completely characterise all inventory uncertainties. Therefore a pragmatic approach should be used - using best available data and expert judgment. Uncertainty analysis is needed in all parameters used, e.g. activity data and EFs. These analyses should be documented, reviewed and used to estimate the total inventory uncertainty.

2.2.4. Recalculation

Slide 44

Recalculation should be considered particularly in the following circumstances: if available data have changed over time; previous methods are not considered good practice; source category becomes key; and new sources are identified. To recalculate, it is good practice to use the same methods and consistent data for all years but but this is not always possible. Therefore the guidelines suggest methods to combine different data for parts of the time series such as splicing, overlap, surrogate, interpolation and trend extrapolation. It should be noted that recalculation should be documented.

2.2.5. Documentation

Documentation is useful for review purposes both internally and externally. Internally, it helps maintain an institutional memory of how the GHG inventory was compiled and helps provide information for new employees to understand what has been done in the past inventories. Externally, it enables reviews by personnel not involved in the GHG inventory development process. A range of issues needs to be documented, including: rationale for choice of methods; assumptions and criteria for selection of activity data and EFs; individuals providing expert judgment for uncertainty estimates; databases and information about their use; worksheets, interim calculations, aggregated estimates and any recalculations; final inventory report; and QA/QC plans as well as their outcomes. All of these issues should be documented, archived and stored for future use. Slide 45-46

In summary, GHG inventories are needed not just to meet the UNFCCC commitments but also to assist other policy goals at the national level. To develop the GHG inventories, the IPCC Guidelines and GPG provide systematic approach to inventory compilation while the UNFCCC Guidelines offer consistent reporting and review procedures. Non-Annex I Parties are strongly encouraged to follow the Guidelines that are appropriate to the local circumstances to facilitate the development of national GHG inventories that are well quantified, well documented and transparent and produce credible, reliable and useful estimates. Slide 48-49

2.3. Setting up a national inventory system

Mausami Desai

To produce high quality GHG inventories, a Party needs a strong national inventory system (NIS) which incorporates all the elements necessary for estimating GHG emissions and removals. Ideally, this should include a central coordination agency as well as arrangements between the agencies and institutions that provide data. To do so, the Party should identify experts (from environmental agencies, universities, research institutes, non-government organisations, etc.) to compile the estimates and to perform procedures for GHG inventory development. Therefore preparing a national GHG inventory and setting up an NIS requires coordination and collaboration across a great number of individuals and organisations. For that reason, the EPA developed a tool to help manage GHG inventory development and preparation and establish an NIS for GHG inventory. Slide 4-7

The EPA template workbook reflects the lessons learned of the EPA from working in concert with developing countries on key elements for establishing a sustainable NIS. The workbook also is based on the United States' long history in developing national GHG inventories. Benefits of the template management approach can be described as the following: Slide 8-15

- It allows the inventory team to focus on documenting essential information. It also facilitates reviews, thus avoiding redundant tasks and unnecessarily lengthy reports;
- It provides a standardised format for documentation. Countries are then able to compare, contrast and share information easily;
- It ensures that roles and responsibilities are well understood;
- It accommodates varying level of capacity. The templates can be applied at sectoral, provincial or national levels;
- It provides a clear starting point for future inventories and improves inventory quality over time;
- It helps fulfill the general IPCC inventory principle - the TCCCA principle of transparency, consistency, completeness, comparability and accuracy and implement IPCC GPG; and

- It helps build a sustainable national GHG inventory system.

Slide 16

The Workbook consists of six templates which will each become a chapter describing key components of the national GHG inventory system. The use and application of each template, which are described below and can also be found online [21] , can guide countries to build an NIS. Each template is described as seen below and is also available online.

2.3.1. Institutional arrangements

Slide 17-24

It is important to establish arrangements (formal or informal) with data providers to ensure access to data that will be used to develop GHG emission estimates. The arrangements may vary depending on the availability of information (some information is publicly available). To complete this template, the inventory team is required to identify relevant organisations and define roles and arrangements for each sector. The arrangements may involve a wide range of institutions performing specific tasks in the GHG inventory development. The inventory team should evaluate arrangements, propose improvements and plan the inventory schedule with specific timeframe for each step (Figure 6). The completion of this template will allow the current and future inventory teams to identify the responsible persons for each sector/source, and to clearly communicate the commitments needed from the responsible entities corresponding to the schedule. Also, the inventory team will be able to identify the existing coordination gaps as well as assess how these gaps could be filled.

2.3.2. Source-by-source background document

Slide 25-28

This important template identifies and organises critical information that should be documented in order to be able to eproduce the inventory. The template can be used for each source and/or sink to systematically describe the national context, the methods, data and EFs which are used to calculate emissions. To complete the template the inventory team is also asked to document data references and contacts/methods used for obtaining activity data and EFs. Upon the completion of this template, the inventory team will understand how estimates were developed, allowing for recalculation if necessary. This template is recommended for all sources, but should be used at minimum for the key categories.

2.3.3. Quality Assurance and Quality Control procedures

Slide 29-32

Implementation of QA/QC procedures enhances the credibility of the national GHG inventory. The QA/QC template should be used to develop a customised QA/QC plan. The first step in developing a plan is to assess and identify any existing QC or QA procedures that are being applied. The next step is to use the template to identify additional QA/QC procedures, define roles for all involved entities and develop a schedule for QA/QC plan. By completing this template, the inventory team will be able to uncover calculation errors, ensure the reliability and accuracy of the inventory and establish cost-effective QA/QC programmes that can be built upon.

[21] For the Template, please visit: http://www.epa.gov/climatechange/emissions/ghginventorycapacitybuilding/templates.html

Fig. 6. National inventory

2.3.4. Archiving system

The inventory archive is the starting point for future inventories. A robust archive can greatly reduce the efforts that future teams have to invest in understanding and recalculating the estimates. The template helps guide the present inventory team in developing a system for storing information used to develop the national GHG inventory and in implementing a strong archive. Slide 33-34

To complete this template, the inventory team needs to document past and current archiving systems. Firstly, the team needs to assess and identify what is needed to improve the existing system. Secondly, the team can then use the template to enhance existing procedures or establish new procedures for archiving relevant inventory compilation materials. Lastly, by completing the template the team will be able to access previous records and easily review and reproduce the estimates if necessary. The team will also be able to provide quicker responses to policymakers, experts or other public inquiries. Slide 34-35

To implement an effective archiving system, the EPA suggested that the information should be archived in a single location and in both electronic and paper formats. The inventory teams should maintain additional copies in the event that materials are lost or damaged. Key information to archive at minimum are: activity data; methods; EFs; estimates; documentation of how these data, factors and estimates were obtained; and documentation of QA/QC procedures, reviews and key Slide 36-37

categories; and NIIP.

2.3.5. Key category analysis

The template and spreadsheet tool gives the inventory team a place to identify and document all key categories, to rank emission sources and to describe their KCA. By completing a KCA and identifying key categories, the inventory team can identify the areas on which should be focused in order to improve estimates (so that resources are used most efficiently).

2.3.6. National inventory improvement plan (NIIP)

Slide 44-49

This template guides the inventory team to prioritise improvements needed to enhance the quality of the GHG inventory, based on needs and information identified in the previous templates. The inventory team can list up to ten of the most important improvement activities and classify the criticalness of these improvements as high, medium or low. The activities to improve the national GHG inventory are, for example, the identification of better quality data, enhancement of coordination and communication among institutions, adoption of higher tier methods and provision of capacity building programmes.

Slide 50

The EPA Workbook is one of the facilitating tools to help develop credible national systems for the GHG inventory. The template approach for managing the inventory development provides a foundation for establishing a national system for GHG inventory. Not only does it help to fulfill the TCCCA principles, but it also creates institutional memory for future inventory teams. By doing so, it reduces future effort and potential costs on inventory compilation. Greater resources can hence be directed to realise necessary improvement activities. During the workshop, it was suggested that the associated financial costs and benefits for each step/element of the national system should be provided, since it would provide clearer guidance towards cost-effective management of the system.

2.4. Institutional arrangements for the national inventory system

Sandro Federici

Slide 5-6

Institutional arrangements (IA) in this context refer to a set of institutional, legal and procedural arrangements in a given country. In other words, IA consist of formal arrangements such as regulations, directives, laws, decrees, or MoUs. The purposes of the IA are: (1) to ensure that the resources and legal authority, which are necessary to perform the functions of the NIS are available; and (2) to set the framework of provisions which rule those functions.

Slide 7-8

For each function of the NIS an implementing entity that has sufficient capacity in terms of financial and human resources, technical expertise and legal authority should be identified. Also, an appropriate IA shall be established for ensuring efficient performance of the function. The established IA may be complemented by other IA such as the arrangements within the entity and/or among entities. In the process of setting the IA, there are some inefficiencies that should be avoided, for example: ((1) a conflict of responsibility where more than one entity is assigned with the same level

of intervention on a function; (2) a vacuum of responsibility when a function is left unassigned to any entity; and (3) a loop where an entity is assigned a function that it exerts on another entity, and the latter entity can, in turn, control the former one.

A well-functioning IA identifies appropriate entities to which they assign the various NIS functions. An appropriate entity should have necessary financial resources, facilities, skilled personnel and legal authority to deal with the assigned functions. Each entity shall be responsible for performing its functions. The functions [22] of the NIS relate to three main areas: inventory planning, inventory preparation and inventory management. Slide 9-10

2.4.1. Functions relating to Inventory Planning (Box 1)

1. Establishing and maintaining the institutional, legal and procedural arrangements necessary to perform the assigned functions, as appropriate, between the government agencies and other entities responsible for the performance of all functions. Slide 11-13

This function applies at a general level to the entity, which sets up the Party's NIS. This entity should be established at a high level in the State administration, e.g. Environment Ministry, Prime Minister Cabinet, Environmental Agency, since it needs strong legal authority and the capacity to allocate both financial and human resources. This entity is responsible for ensuring the functioning of the NIS and it has the power to adjust any non-functioning IA and/or to add new IA, as needed.

This function also applies at the level of each entity, which sets up each single IA with another entity/ies to perform one of its assigned functions. The entity, in analogy with comments provided in the previous paragraph, is responsible for ensuring the functioning of the IA.

2. Ensuring sufficient capacity for the timely performance of the inventory functions, which include data collection for estimating GHG emissions and arrangements for technical competence of staff involved in the GHG inventory development process. Slide 14

3. Designating a single national entity with legal authority within the national administration and overall responsibility for preparing the national GHG inventory - the GHG inventory unit. The unit shall have the needed financial resources, facilities and technical expertise to realise its responsibilities. Preferably it should be different from the entity maintaining the NIS, e.g. the National Statistics office, the Environmental Agency. Slide 15

4. Making available the mailing and electronic addresses of the national entity responsible for the GHG inventory. The entity that prepares the GHG inventory shall make its identity public and provide channels to be contacted. Slide 16

5. Defining and allocating specific responsibilities in the GHG inventory development process, including those relating to the choice of methods, data collection, archive system, and QA/QC procedures. In defining responsibilities, the role of each involved entity shall be specified and corresponding institutional, legal and procedural arrangements shall be clarified. Slide 17

A well-functioning NIS identifies and/or sets up an appropriate entity, which allocates all the needed functions and responsibilities in an unequivocal manner. This function applies at the general level to the entity, which sets up the country's NIS. This function also applies at the level of each entity to which a function has been assigned. The entity shall establish IA with other entities in order to obtain all needed elements for performing the function. Slide 18-19

[22] UNFCCC, (2005) Decision 19/CMP.1 Guidelines for national systems under Article 5, paragraph 1, of the Kyoto Protocol in The Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol on its first session, 28 November- 10 December 2005. Montreal

6. Elaborating an inventory QA/QC plan, which describes specific QC procedures to be implemented during the inventory development process, facilitates the overall QA procedures to be conducted on the entire GHG inventory and establishes quality objectives. The assigned entity should be involved in the GHG inventory development process and should have the required technical expertise. This function could be assigned to the same entity that prepares the GHG inventory - the GHG Inventory Unit.

Slide 20

7. Establishing processes for the official consideration and approval of the GHG inventory, including any recalculations, prior to its submission and responding to any issues raised during the inventory review process.

Slide 22-24

The national GHG inventory shall be part of the official national statistics and endorsed by the State Administration. The entity that maintains the NIS should provide the official approval of the inventory. Providing answers and solutions to issues raised during the inventory review process is a key function, which aims to ensure transparency and comparability of GHG estimates. This function shall be assigned to the same entity as the GHG inventory unit.

8. As part of its inventory planning, the Party should consider ways for improving activity data, EFs, methods and other relevant technical elements of the GHG inventory. Information obtained from the implementation of QA/QC activities and any review process should be considered for the improvement of GHG inventory and its NIS. This function applies at the general level to the entity, which sets up the Party's NIS, and also applies to the level of each entity to which a function has been assigned.

The IA should be set up in a manner that promotes continual improvement. It should be ensured that inputs coming from quality assessment processes, such as the inventory review, the quality assurance and quality control procedures, could be implemented in the process of maintenance and improvement of the IA.

2.4.2. Functions relating to Inventory Preparation (Box 2)

For all these functions, except for the last two, the assigned entity is the one that prepares the GHG Inventory (the GHG Inventory Unit). In the case of Annex I Parties, this entity is usually a central government agency.

9. Identifying key categories following the methods described in the IPCC Guidelines. The most relevant sources/sinks shall be identified in order to channel resources and efforts and to properly frame fundamental IA among entities that are able to provide necessary data for estimating relevant source/sink and the entity that is entitled to prepare the GHG inventory.

Slide 25

10. Preparing estimates in accordance with the methods described in the IPCC Guidelines and ensuring that appropriate methods are used to estimate emissions/removals from key categories. The estimates of GHG emissions and removals should be prepared by methods in consistent with the IPCC Guidelines and Guidance.

Slide 26

11. Collecting sufficient activity data and processing information and emission factors as necessary to support the methods selected for estimating anthropogenic GHG emissions by

sources and removals by sinks. IA shall be set in order to ensure the needed flux of information/data for the preparation of the national GHG inventory. Slide 27

12. Making a quantitative estimate of inventory uncertainty for each category and for the inventory in total, following the IPCC Guidelines. The likelihood of reported GHG estimates shall be assessed; this information should drive further improvements of the GHG inventory and its NIS. Slide 28

13. Compiling the national GHG inventory. This is a reporting function.

14. Implementing inventory QC procedures in accordance with its QA/QC plan following the IPCC Guidelines. This function consists of internal routine checks in order to ensure that the workflow will not be biased . Slide 29

15. Providing data for a review of the inventory by personnel that have not been involved in the GHG inventory development, preferably an independent third party, before the submission of the inventory, in accordance with the planned QA activities. Slide 30

This function shall be assigned to an external entity (national or international) with the necessary technical expertise, with the aim to have an independent checking of errors and assessment of transparency, completeness, accuracy, comparability and consistency of the GHG inventory. It is also helpful to have public review in order to promote the transparency of the inventory development process. Slide 31

16. Based on the QA/QC outputs, the Party shall re-evaluate the GHG inventory planning process in order to meet the established quality objectives. This function applies to every entity to which a function has been assigned. The entity has to implement the outputs coming from quality assessment procedures (QA, QC and other review processes). Slide 32

2.4.3. Functions relating to Inventory Management (see Box 3)

For all these functions, the assigned entity could be the same entity as the GHG inventory unit; however, a different entity may better ensure that data are not modified after archiving and that any potential incident affecting the GHG inventory unit is not reflected in the archived material/information.

17. Archiving inventory information for each year. This information shall include all disaggregated EFs, activity data and documentation about how these factors and data have been generated and aggregated for the preparation of the inventory. This information shall also include internal documentation on QA/QC procedures, external and internal reviews, documentation on annual key categories and key category identification and planned inventory improvements. A rigorous system for storing all information on GHG estimates and processes employed to achieve them is necessary for ensuring sustainability of the inventory process. Slide 33

18. Providing access to all archived information used by the Party to prepare the GHG inventory. Slide 34

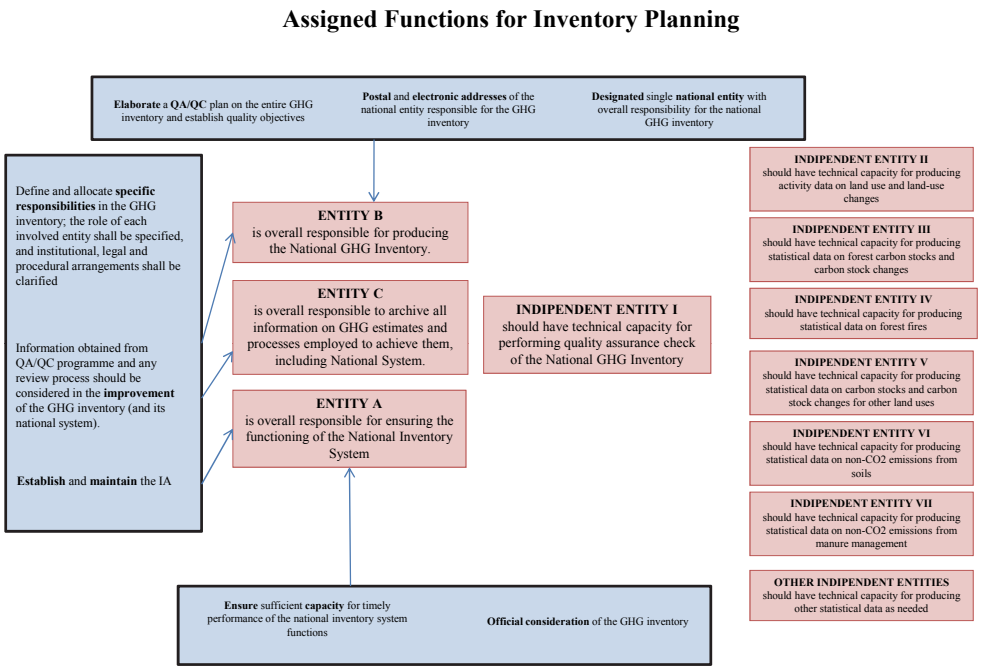
19. Responding to requests for clarifying GHG inventory information resulting from

the different stages of the review process of the GHG inventory information, and information on
Slide the NIS, in a timely manner.
35 As part of its inventory management, each Party should make accessible the archived information accessible by collecting and gathering it in a single location. One single access policy is necessary for ensuring safe management of stored information, including tracking access and potential modi-
Slide fication.
36 In conclusion, the IA framework is the set of relations that governs the flow of resources, data and information among elements of the NIS. A robust framework of IA will ensure the proper planning, preparation and management of national GHG inventory and the consequent delivery
Slide of consistent estimates with the best achievable quality. In order to be robust, an IA should be
37- unambiguous (see Box 4) and should be sustainable, i.e. it should be designed taking into account
40 national circumstances and consequently should assign resources needed for performing the function to which it relates. It should be subject to improvements as a consequence of quality procedures and reviews. Boxes 5 and 6 provide an example of a sustainable NIS and of the requested IA; in this example the functions related to archiving and quality assurance are assigned to the same entity.

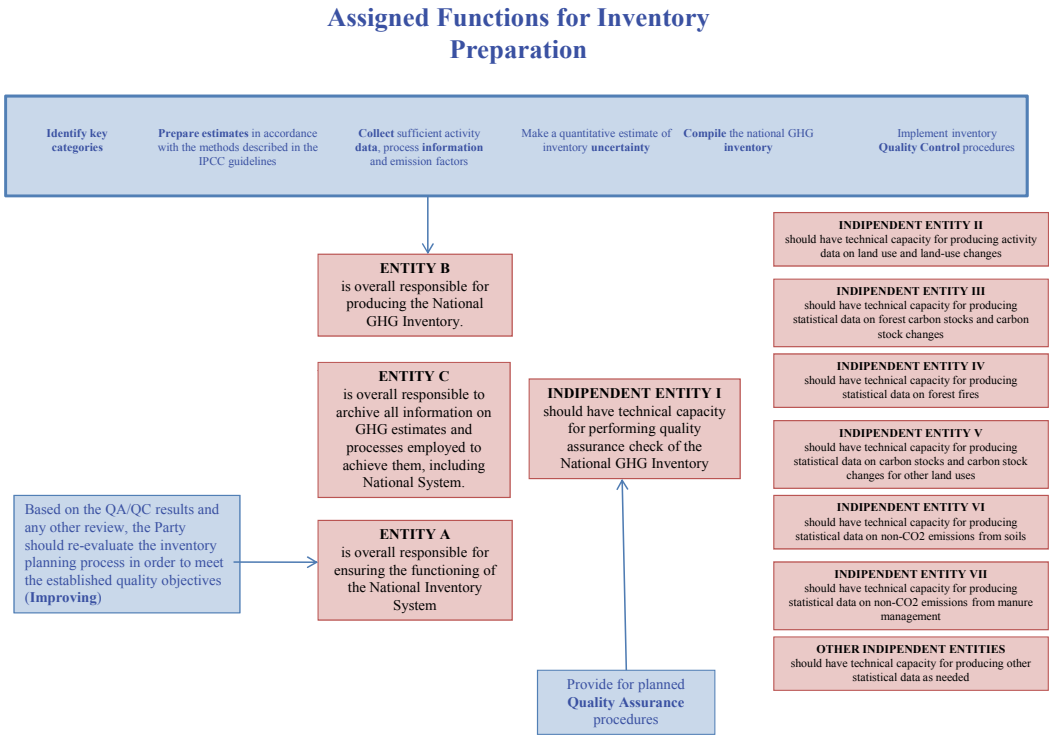
An analysis of the NIS in Annex I Parties shows that the majority (22 Parties) has national legislation to designate an entity with overall responsibility for the development of the GHG inventory. The rest of Annex I Parties, despite the absence of a legislative backing, reported to have an entity assigned with these responsibilities. It is worthwhile to note that national legislation that establishes the NIS is a useful tool to ensure the proper and exclusive budget allocation of budget and staff for planning, preparing and managing the national GHG Inventory to ensure a proper functioning of the NIS.

Based on the latest national GHG inventory submitted to the UNFCCC, over a quarter of the Annex I Parties included in the analysis (10 Parties) reported the use of legal commitments to secure coordination and cooperation among involved agencies to support data collection, commonly in form of MoUs, formal arrangements and contracts. The popularity of these legal commitments, compared to the national legislation, is likely to stem from their flexibility. For example, an MoU between the entity responsible for the GHG inventory and the data providers helps specify the framework for data supply, e.g., data quality, format, timeliness and security to underpin the GHG inventory. At the same time, an MoU is flexible and can be easily amended according to the needs and identified failures. Moreover, it is quickly established and may be cancelled once the agreement period is over.

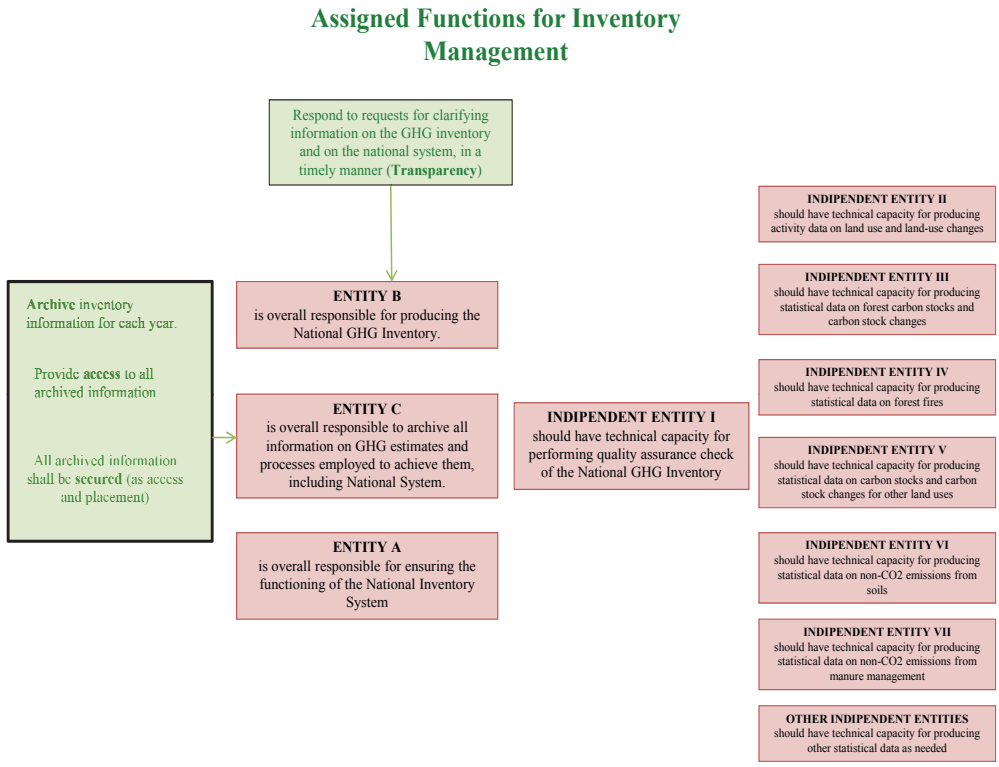
Other Parties use a less formal approach that generally comprises working groups, coordinating teams, advisory boards and steering committees. Such mechanisms not only ensure timely delivery of the inventory, but they also provide an information exchange platform. Finally, the analysis reveals that most Parties are committed to improve the legal, institutional and procedural arrangements of their GHG inventory since, despite their efforts, even Annex I Parties still encounter difficulties due to lack of expertise, data and financial resources.



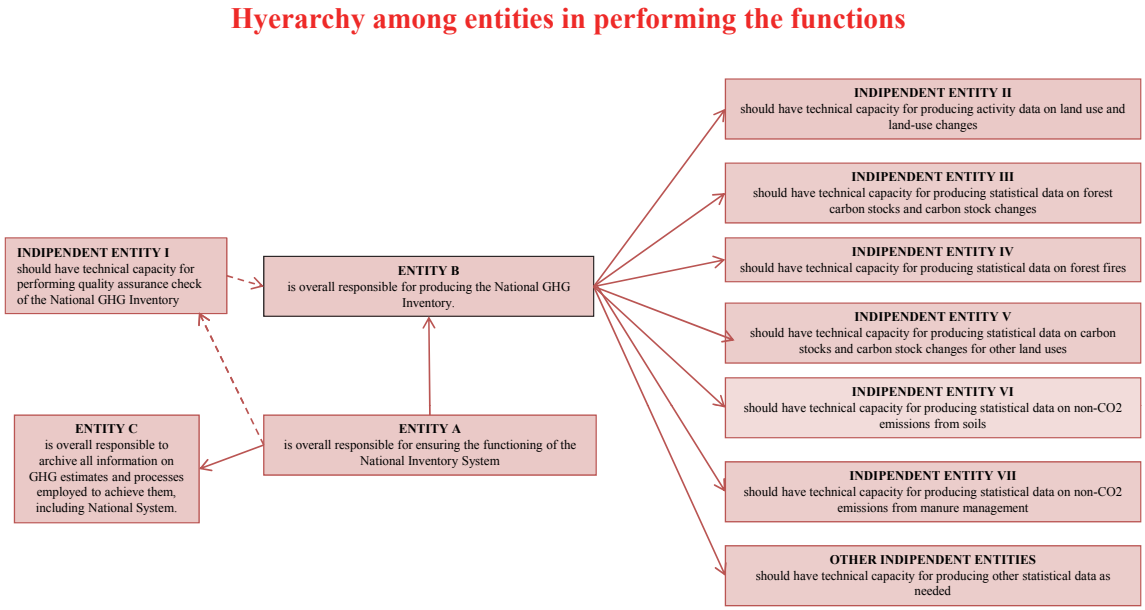
Box 1: Scheme of assignment of functions related to inventory planning



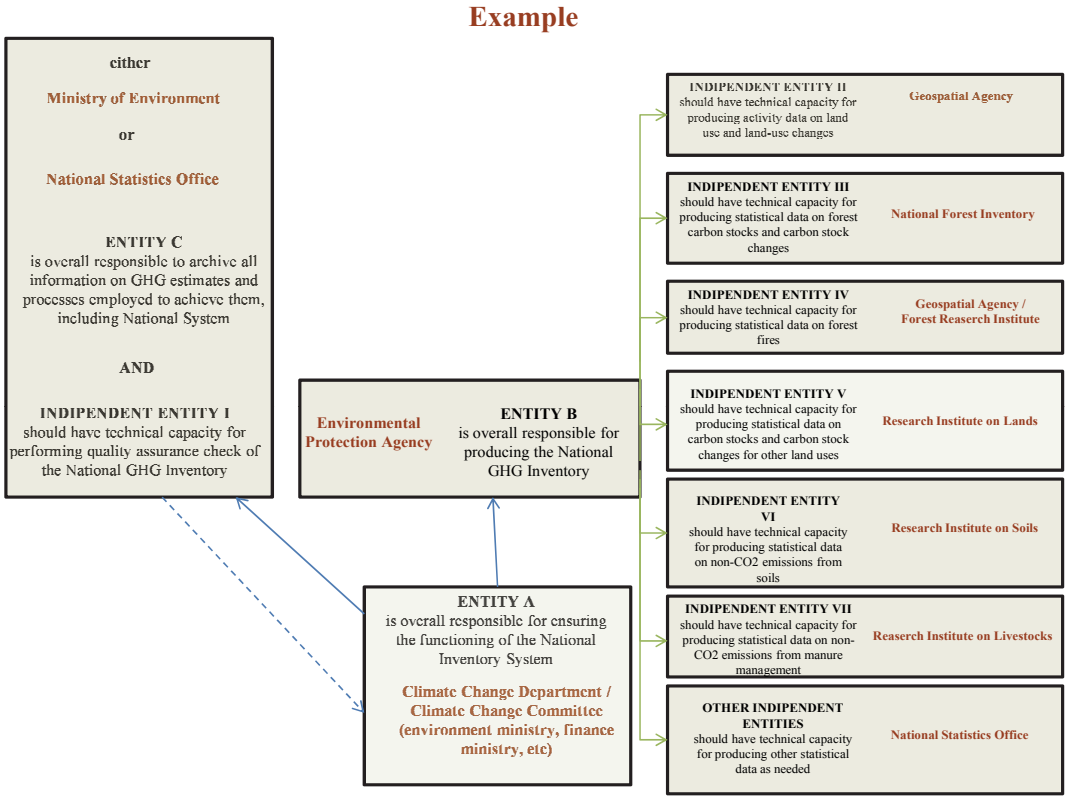
Box 2: Scheme of assignment of functions related to inventory preparation



Box 3: Scheme of assignment of functions related to inventory management



Box 4: Hierarchical order in Institutional Arrangement



Box 5: Example of a sustainable National Inventory System

2.5. Documentation and category-by-category description

Marina Vitullo

Slide 3-4

Category-by-category Description (CbC) records all information regarding methods and data used for estimating the emissions and removals from the category. The purposes of the CbC are: (1) to reproduce the GHG estimates; (2) to assess consistency of methods and data with the IPCC Guidelines and the UNFCCC requirements; and (3) to assess the correspondence of estimates with the category boundary.

Slide 5-6

To conduct CbC, transparency is a key principle and completeness is an essential ingredient to achieve transparency. To ensure transparency, CbC has the following requirements:

- The assumptions and methodologies used should be clearly explained for each source or sink category;
- The uncertainties in the data used for all source and sink categories should be quantitatively estimated;
- Any methodological or data gaps should be documented;
- A QA/QC plan should be prepared for each source and sink category; and
- All information that are relevant to methods and data used, e.g. all reference material, estimates, calculation sheets, internal documentation on QA/QC procedures, external and internal reviews,

key categories and planned improvements, should be archived.

For each category the following items should be reported: category information, methodological information, data information and estimates' assessment. Slide 7

(1) Category information comprise sector affiliation, gas (es), relevance (is it a key category?), category description, definition and boundaries, related human activities and impacts, impacts of indirectly human-induced and natural disturbances, historical trends in emissions and removals and any other national circumstances. (2) Methodological information consists of method description, reasons for method selected, assumptions, equations and related processes, inputs, sensitivity analysis, outputs and reference(s). (3) Data information includes input data (activity data, EFs/carbon stock change factors/other parameters, parameters and country specific factors) and intermediate output data (outputs by an equation used us inputs in a next-step equation). (4) Estimate assessment covers the consistency with the IPCC Guidelines and the UNFCCC requirements and with the category definition and boundary. Slide 8-13

In conclusion, the CbC requires the description of information on data and methods used for estimating the GHG emissions and removals from each category to be described. The CbC is essential for conducting KCA, ensuring transparency and assessing consistency with the IPCC Guidelines and the UNFCCC requirements. Slide 40

2.6. Key category analysis

Daniela Romano

The compilation of a high quality GHG inventory requires a number of measures to be followed. For example, accurate methodologies should be used, while detailed activity data should be collected. However such measures require additional resources, making it impossible to perform them for every category. Therefore, the efforts should be focused on specific categories relevant to the overall national GHG inventory. The concept of "Key Categories" was thus introduced by the IPCC as a tool to prioritise resources for improving national GHG inventories. Slide 4-7

As defined in the 2006 IPCC Guidelines [23] as well as previous IPCC Guidelines, key categories are those categories with significant influence on a Party's total inventory in terms of the absolute level, trend of emissions over time, or uncertainty in emissions and removals. Originally, the concept of key categories was attributed to emissions excluding the LULUCF sector. Later, it was expanded to cover LULUCF sector. The 2006 Guidelines provide a harmonised method to deal with both emissions and removals in a category and correct some inconsistencies between the earlier versions. Slide 8-9

The identification of key categories should follow a systematic and objective process. Two quantitative approaches as defined in the 2006 IPCC Guidelines aim to identify those categories from the perspective of the level and the trend. There are two approaches: Approach 1 and Approach 2 (see below). The major difference between the two approaches is that only Approach 2 accounts for uncertainties of relevant categories. Qualitative criteria can also be used. National experts can estimate whether a specific category is likely to show an increase of emissions or decrease of removals in the near future, whether it is supposed to have potential high uncertainty (but no quantitative assessment of uncertainties has been carried out) and whether it is potentially a key category (other countries with similar circumstances can be observed). Slide 9-14

To assess level and trend key categories in accordance to Approach 1 and Approach 2, the steps

[23] IPCC, (1997) IPCC Guidelines for National GHG Inventories

are specified as the following:

Approach 1

Slide 15-17

Level assessment

$$L_{x,t} = |E_{x,t}| / \sum_{y} |E_{y,t}| \quad (1)$$

where
$|E_{x,t}|$ = Absolute value of emission and removal estimates of category x in year t;

$$\sum_{y} |E_{y,t}|$$

= Total contribution, which is the sum of the absolute values of emissions and removals in year t.

Key categories are those that, when added together in descending order of magnitude, constitute more than 95% of the total emissions for a given year. Therefore, according to the results of the equation above, the largest category should enter in the list of key categories followed by the next largest categories until the cumulative total is greater than 95% of the total emissions for a given year (usually the most recent year available).

Slide 18-21

Trend assessment

The contribution of each category's emission trend to the overall trend of the GHG inventory can be assessed by the Parties, if more than one year of GHG inventory data are available, according to equation (2):

$$T_{x,t} = |E_{x,0}| / \sum_{y} |E_{y,0}| * |[(E_{x,t} - E_{x,0}) / |E_{x,0}|] - [(E_t - E_0) / \sum_{y} |E_{y,0}|] \quad (2)$$

where
$|Ex, 0|$ = Absolute value of emission and removal estimate of category x in the base year;

$$\sum_{y} |Ey, 0|$$

= Total contribution, sum of the absolute values of emissions and removals in year 0;
Ex,t and Ex,0 = Real values of estimates of source or sink category x in years t and 0, respectively;
Et and E0 = $\sum_{E_{y,t}}$ and $\sum_{E_{y,0}}$ = Total inventory estimates in years t and 0, respectively.
The source or sink category trend is therefore a change in the category emissions over time. The change could be calculated by subtracting the base year estimates, for a category, from the latest inventory year estimates and divided by the absolute value of the latest inventory year estimates. The total trend is the change in total emissions of the GHG inventory over time, computed by subtracting the base year estimate for the total inventory from the current year estimates and divided by the current year estimates. This methodology identifies categories that have a trend different from overall inventory trend. In this case, the largest category should enter in the list of key categories followed by the next largest categories until the cumulative total is greater than 95%

of the total trend.

Trend assessment

Uncertainty estimates are an essential element of a complete GHG inventory. Uncertainties should be addressed in order to avoid the potentially severe consequences of inaccurate information and ensure the monitoring against targets, i.e. accurate estimates and comparable figures among countries. There are different sources of uncertainty such as activity data that were derived from gaps in time series, use of proxy variables, lack of references, EFs obtained by scarce information, lack of measurements and poor sample representativeness. Owing to a variety of potential uncertainty sources, it is not always easy to attribute an uncertainty figure to an emission estimate. Whenever data are not available (for instance, not provided by the national statistical institutes or other institutes, or there is no data set of data or measurements too assess a range or a standard deviation), the relevant expert can use figures provided in the IPCC guidelines or set values according to his/her or other experts' judgment. Slide 22-24

The IPCC 2006 Guidelines define two approaches for estimating uncertainties: Approach 1, based on error propagation equations, and Approach 2, based on Monte Carlo simulations. If there is no sufficient information on how data, EFs and other parameters are derived, every approach is highly affected by expert judgement. In such case, Approach 1 should be implemented because it is simple enough and transparent for the purpose of GHG inventory. As for the assessment of the key categories following Approach 2, once the uncertainties are calculated for each category, they are incorporated into the analysis by weighting the results from Approach 1 level and trend assessment. Slide 25-30

Level assessment Slide 31-32

For the key category level assessment, the contribution of each category's emissions to the total national inventory level, should be calculated according to equation (3):

$$LU_{x,t} = (L_{x,t} * U_{x,t}) / \sum_{y} [(L_{y,t}| * U_{x,t})] \quad (3)$$

where $L_{x,t}$ = Level assessment computed as in equation (1); $U_{x,t}$ = Category uncertainty in year t calculated as described in chapter 3 of the 2006 IPCC Guidelines. After computing level assessment with uncertainty, results should be sorted according to decreasing order of magnitude, similarly as in Approach 1. Key categories are those that constitute more than 90% of the total emissions for a given year.

Trend assessment

The contribution of each category to the trend in the total inventory can be assessed if more than one year of inventory data is available, according to equation (4):

$$TU_{x,t} = (T_{x,t} = (T_{x,t} * U_{x,t}) \quad (4)$$

where $T_{x,t}$= Trend assessment computed as in Approach 1; $U_{x,t}$= Category uncertainty in year t calculated as described in chapter 3 of the 2006 IPCC Guidelines. After computing trend assessment with uncertainty, results should be sorted according to decreasing order of magnitude, as in Approach 1. Key categories are those that constitute more than 90% of the total trend.

The results in terms of number and identity of key categories may differ from one approach to

Slide 33-35 another in consideration of the relevant uncertainty and weight of the category out of the total. If both approaches are implemented, the results of Approach 2 can be used for prioritising activities to improve inventory quality and reduce overall uncertainty. As an example of the KCA by Approach 1 and Approach 2, 2008 GHG inventory of Italy is presented. National emissions are disaggregated into categories proposed in the IPCC guidelines. Other categories are added to reflect specific national circumstances. Disaggregation to very low levels should be avoided since it may split an important aggregated category into many small subcategories that are no longer a key category. Each GHG from each category should be considered separately, unless there are specific methodological reasons for treating gases collectively.

In conclusion, after the identification of key categories, improvements should be prioritised by taking into account the expected future relevance of the category and a cost-effectiveness analysis and should be described for each key category. Any key category for which higher methods cannot be Slide 36-38 followed should have priority for future improvements. In this regard, emissions of key categories, being the most important in terms of absolute weight and/or combined uncertainty, should be estimated with higher tiers to ensure the TCCCA principles among the Parties.

2.7. Quality Assurance and Quality Control

Karsten Dunger

QA/QC procedures are regarded as one of the key elements in constructing GHG inventory. Slide 4-7 They can help achieve the TCCCA principle of the IPCC. The outcomes of the QA/QC procedures result in reassessment of GHG inventory and improvements in GHG estimations. QA refers to a system of review procedures. The reviews help verify that measurable objectives were met and ensure that the inventory represents the best possible estimates. The QA procedures should be performed by personnel not directly involved in inventory compilation. On the other hand, QC refers to a system of routine technical activities to assess and maintain quality. The system helps identify errors and facilitate documenting and archiving inventory material. The QC procedures should be performed by personnel compiling the inventory.

To implement QA/QC procedures, one should find a balance between the requirements for QC Slide 8-10 procedures and requirements for timeliness and cost-effective implementation. To find such balance, the following parameters should be evaluated: resources, time, frequency, level, data availability, data access, EFs, requirements for documenting and archiving information, effect of QA/QC procedures on improved estimates and reduced uncertainties. Additionally, to prioritise and intensify the effects of QA/QC procedures, the following questions should be asked.

(1) Is this source/sink a key category? Key categories represent an important part of the total Slide 11 emissions of the inventory.

(2) Does methodology use complex modeling steps and/or large inputs from outside database? Such methodology deserves special QA/QC attention.

(3) Are EFs and/or other parameters when estimated significantly different from the IPCC defaults? If so, the Party should investigate how the EFs or parameters were derived and if there is any error during the process.

(4) How much time has passed since EFs and/or other parameters have been updated? Because the EFs or parameters may change over time, the longer the time passed since the EFs or parameters were derived, the higher QA/QC attention should be paid.

Although confidential data cannot be revealed publicly in the GHG inventory, the data also needs

to have QA/QC procedures performed just like publicly available data. Slide 12

Major elements of the QA/QC consist of a QA/QC coordinator, clearly defined roles and responsibilities, QA/QC plan, QC procedures (general QC procedures Tier 1 or category-specific QC procedures Tier 2), QA and reviews procedures, reporting, documentation and archiving of QA/QC procedures. As regards roles and responsibilities of the QA/QC procedures, the following consideration should be taken into account: Slide 13-14

- Particularly in the case where national GHG inventory involves external data supplier, the roles and responsibilities of QA/QC procedures may be passed on to the external data suppliers. They could perform QC as part of their contracts to deliver the data.
- The QA/QC coordinator, who often times, the coordinator is the same entity as the national GHG inventory coordinator, should be nominated. Slide 15-17
- QA/QC procedures should be performed for data collection, method selection, EFs, activity data and other parameters, estimation of estimates and removals, uncertainty assessment, documentation and archiving.

Some example of roles and responsibilities of the QA/QC procedures of Germany are described. The compilation of national GHG inventory involves a large number of experts and institutes. Responsibilities for performing QA/QC procedures are thus distributed as follows: Slide 18-19

1)The source specific expert is responsible for data collection, data entry, estimations and the drafting of the text for GHG inventory report. The entity therefore is assigned with responsibility for performing QC over data collected and emission estimates.
2) The sectoral coordinator is responsible for coordinating data and estimates for an entire sector. His/her QA/QC role is thus the approval of completed data, estimates and texts of the sector.
3) The source specific contact person refers to external data supplier for specific category. The entity is under direct supervision of the source specific expert and sectoral coordinator, who provide guidelines and supervise the entity on the data requirements in accordance with the QC procedures.
4) The national inventory coordinator has overall responsibility for compiling the national GHG inventory report. Henceforth he also is responsible for QC procedures on the entire national GHG inventory report text.
5) The coordinator for central database on emissions (CSE) is responsible for maintaining the database, emission estimates and aggregation, QC procedures on activity data, EFs and other parameters as well as on the changes (if any).
6) The coordinator for quality system on emission (QSE) has responsibilities to maintain and improve the QSE system, which includes the QA/QC checklists, QA/QC plan and revision and QA/QC handbook.
7) The coordinator for the national inventory system is responsible for ensuring the institutional arrangements and timely delivery of the national GHG inventory that is in accordance with the requirements.

The QA/QC plan consists of procedures that will be implemented, schedule a timeframe for the activities, concluded from previous reviews (internal, external and official UNFCCC reviews) to improve the plan, from internal document for ensuring that the inventory serves the purpose and allows for improvement, and list of data quality objectives. The quality objectives should be measurable and refined upon the following principles: timeliness, completeness, consistency, comparability, accuracy, transparency and improvement. The objectives should comprise concrete targets to be achieved in the inventory. Slide 20-23

In developing the QA/QC plan, the Party may adhere to the international standards and guidelines, e.g. International Organisation for Standardisation (ISO) standard, in order to enhance quality of the GHG inventory up to the internationally accepted level. Nonetheless, the QA/QC plan should take into account national circumstances. Once the QA/QC plan is developed, it can be used for subsequent inventories, though with periodic revisions of the plan. Slide 24

General QC procedures (Tier 1) comprise generic quality checks related to calculations, data

processing, completeness and documentation that are applicable to all inventory source and sink categories. The results of QC procedures need to be documented. Given the limited resources, it is not possible to check all aspects of GHG inventory input data, except for data sets and processes. Special attention should be paid to parts in the GHG inventory where data is derived from external sources. Category-specific QC procedures (Tier 2) require knowledge of specific category, specific data and parameters. They are usually performed in addition to general QC procedures (Tier 1). They are applied on a case-by-case basis focusing on key categories as well as on categories with significant methodological and data changes. If a higher tier method is used for GHG estimations then higher tier QC (Tier 2) should be applied.

Slide 25-30

Regarding QC on EFs, QC procedures should ensure that IPCC default EFs used are applicable to the country's national circumstances, since there are many existing default EFs . QC procedures on country-specific EFs should focus on the background data used for deriving the EFs: where the data comes from (e.g. site-specific, literature etc.) and if the data quality is sufficient. Furthermore, to perform QC procedures on EFs, the EFs could be cross checked - comparing country-specific EFs with IPCC default EFs, comparing EFs between countries and comparing country-specific EFs with plant-level or site-specific EFs. Concerning QC procedures on models, the more complex the models are the more extensive QC procedures should be applied.

Slide 31-32

Regarding QC procedures on activity data, the procedures could be performed on the reference source for national activity data in order to evaluate secondary data, particularly data, which are used but were generated for other purposes. Also, the procedures could be done by comparing independently compiled data (e.g. government statistics with FAO data), comparing samples (extrapolate plant specific data) and conducting trend checks.

Slide 33

As an example, QA/QC checklists of Germany list all individual objectives in the emission reporting process. They facilitate progress review of individual objectives and are made available to all persons responsible for QA/QC. Where individual objectives are not met, a pertinent entry must be made in the improvement plan.

Slide 34-36

QA procedures provide reviews and audits to assess quality of GHG inventory, determine conformity of procedures taken and identify areas for improvements. Additional to general and category specific QC procedures, inventory should be reviewed in parts of completely by a personnel not involved in the inventory compilation process - expert peer reviews. The reviews of assumptions, calculation methods and results should be conducted by experts in relevant technical fields. Given the limited resources, key categories should be given a priority.

Slide 31-47

2.8. National inventory improvement plan

John Venezia

Based on experiences in developing national GHG inventories and in working with developing countries on establishing a sustainable national system, EPA template workbook was developed. The workbook consists of six templates, which becomes a chapter of the national GHG inventory system report. The templates are institutional arrangements, source-by-source background document, QA/QC procedures, archiving system, KCA and NIIP.

Slide 3-5

The last template, NIIP, facilitates continual improvement of GHG inventories. It helps prioritise improvement activities of NIS, adhere national GHG inventory to the internationally accepted principles, meet the needs of policy-makers, researchers and the public and facilitate continual inventory improvement. Documentation of improvement plan helps guide the inventory team to improve quality of GHG inventories for the next development cycle - an improve-learn-guide approach

Slide 6-9

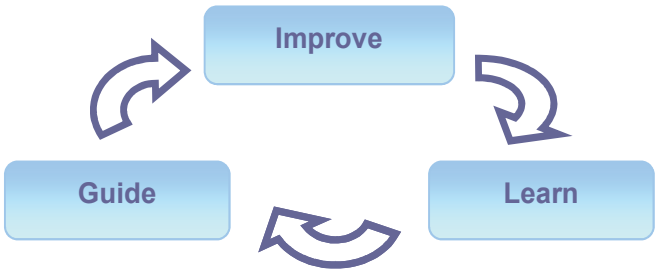


Fig. 7. Approach for continuous inventory improvement

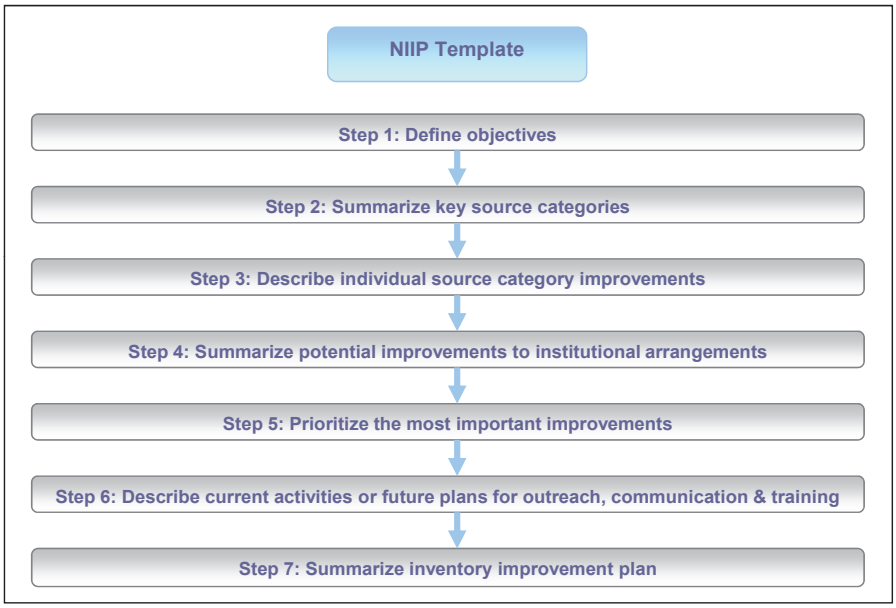


Fig. 8. Steps to develop NIIP

(Figure 7).

Improvement areas often center around five issues: identifying better activity data with better quality, coordination between institutions especially for data collection, adopting higher tier methodologies or moving towards country-specific EFs, building capacity by training of current staff and hiring new staff.

There are seven steps to complete the NIIP template (Figure 8). Slide 10

Step 1: Define objectives for developing an NIIP

The objectives of NIIP are likely to be common among the countries. For example, the objectives are to identify areas for improvement, to propose projects and to adhere to the UNFCCC inventory principles. However, the countries are encouraged to customise the text according to their national circumstances. In such case, the inventory team should also identify how the team arrived to these objectives. Slide 11

Step 2: Summarise key categories Slide 12-13

To improve national GHG inventory, it may be necessary to consider more accurate methodologies, country-specific EFs and/or collect more activity data. Due to the limited resources, it is not possible to make improvement for all sources. Therefore key categories should be focused, since they have the greatest contribution to the national emissions. Summarising them involves bringing in information from the KCA. The section could be filled out using the completed KCA template.

Slide 14-16

Step 3: Describe individual source category improvement

The inventory team reviews the completed source-by-source documentation templates and identifies improvements associated with each source category. The team should specify the needs associated with each source such as the need for more complete activity data, the use of higher tier methodology and the need for country-specific EFs. Subsequently, the team proposes ways to address the identified needs.

Some examples of potential improvements to source categories are: to obtain better activity data though GIS land use maps, to move towards higher tier methodology by using land-use or ecosystem process model, to use country/regional specific EFs by conducting soil carbon analysis and to conduct QA/QC targeting key sources.

Slide 17-19

Step 4: Summarise improvements to institutional arrangements

The inventory team summarises improvements that have been identified for the IA such as agreements between the inventory manager, inventory team and data providers. The arrangements include both formal and informal approaches. Examples of ways to improve IA are the identification of additional institutions to support the GHG inventory development, improvement of information sharing among the involved agencies, employment of additional staff and development of better archiving system.

Slide 20-21

Step 5: Prioritise the most important improvements

The inventory team should identify ten critical areas for improvement and rank them (high, medium and low). The ranking should consider the significance of categories to the total emissions and trend as identified in key category analysis as well as the confidence in emission estimates. The team should also discuss why they have identified specific improvements as high priority.

Slide 22-25

Step 6: Communication, outreach and training

The inventory team describes the current and future plans for communication, outreach and training. The team raises awareness about the national GHG inventory by discussing its importance and benefits of producing a regular national inventory and attempts to identify additional experts to improve the inventory. The team also trains the inventory staff on national GHG inventory system. Potential activities to perform are to develop a website on the national GHG inventory, to publish soil and land-use maps, to raise awareness with government, academia and the public, to create a process for expert or public reviews and to schedule meetings with stakeholders.

Slide 26-27

Step 7: Summarise the inventory improvement plan

The inventory team summarises national priorities and proposes projects to address the most important improvements needed (as identified in Step 5). The proposal should involve specific project with estimated personnel, budget and equipment (software) needed.

By completing the NIIP template, the inventory team can help justify the improvements and

needs in a systematic manner. The EPA Workbook is one of the facilitating tools provided by Annex I countries for non-Annex I countries in order to help develop credible national systems for the GHG inventory. The efforts are highly appreciated, according to Papua New Guinea. All the templates including the NIIP are available online [24]. Slide 28

2.9. Inventory archive system

Riitta Pipatti

Archives refer to a collection of records, as well as the location where these records are kept. The GHG inventory archives consist of records that have been created during the development of the GHG inventory including references to research and other data used in the inventory. The archive system is crucial for sustaining the national GHG inventory system for many reasons. Slide 4

The archive system is a foundation for continuous preparation and development of GHG inventories by the inventory team. It is particularly important when the inventory team or its member change, since it serves as institutional memory - the new members learn about the previous inventories through archived information. The inventory team will benefit from effective data management of the previous inventories when compiling a new GHG inventory. A functional archive system enhances transparency and ability to reproduce the national GHG inventory.

Archived information should include a description of the methodologies used in the inventory preparation, all disaggregated EFs, activity data, and documentation on how these factors and data have been chosen, collected and used in the preparation of the GHG inventory. The information should also cover internal documentation on QA/QC procedures, external and internal reviews as well as associated responses, documentation of annual key categories and their analysis and uncertainty estimates. Final inventory products, e.g. national communication, national inventory report and other materials submitted to the UNFCCC, should also be archived. Preferably, the archive of final products should be conducted by inventory year in both word and pdf-files format because the pdf files cannot be easily changed. Slide 5-6

Personnel with vital roles and responsibilities for the establishment of the inventory archive system are: Slide 7-9

1) Archiving coordinator

The archiving coordinator is responsible for ensuring that all archiving procedures are performed and the necessary information such as supporting documents, databases, spreadsheets and models, is archived. The archiving coordinator is also responsible for preparing an archiving plan and should periodically update it based on experiences gained. The coordinator should also identify the responsible persons for carrying out the specific archive procedures and ensure the implementation of the plan. The inventory manager or a sectoral expert can act as the archiving coordinator because the task does not require full time resources.

2) Sectoral experts

The responsibilities of the sectoral experts include documenting the relevant information on their contribution to the national GHG inventory development. The information covers calculation meth-

[24] available at: www.epa.gov/climatechange/emissions/ghginventorycapacitybuilding

ods, activity data and disaggregated EFs used as well as associated information such as reasoning for their choices, source of data and contact persons. The information extends to QA/QC procedures and verification measures implemented, uncertainty estimation and calculation sheets and models used to prepare the inventory. Preferably, once the inventory is completed the information should then be delivered to the archiving coordinator and stored at the centralised archive. In some cases, archiving and storage at the inventory expert's organisation can be acceptable as long as access to the information by the inventory manager, archiving coordinator and external reviewers is ensured.

3) Inventory manager

Inventory manager has overall responsibility for developing the national GHG inventory and hence supervisory role over the archiving coordinator and sectoral experts. The inventory manager can also perform the tasks of the archiving coordinator. To establish an archive system, there are 5 steps to follow.

Step 1: Designating an archiving coordinator. The inventory manager can also be the archiving coordinator.

Step 2: Developing an archive plan, which should be updated periodically based on experiences gained.

Step 3: Defining and communicating the roles and tasks of each inventory team member in archiving.

Step 4: Implementing the plan (procedures, development of templates, checklists, etc.)

Step 5: Evaluating, developing and updating the plan periodically.

Slide 10-13

As an example, the inventory archive system of Finland is used in order to illustrate the roles and responsibilities of personnel involved in the system. The inventory team at Statistics Finland has a quality manager, who has been also been given the tasks of an archiving coordinator. Her main responsibility is to produce and implement the archive plan for the entire inventory. Archiving at Statistics Finland consists of passive and active archive. The passive archive contains numerical inventory data saved in relational database and it serves mainly as a safeguard in the case that the active archive is lost due to unexpected events. The active archive contains three main folders located in the common server of Statistics Finland. The folder named "GHG archive" contains the previous inventory submissions and related information on calculation sheets, models, metadata, QA/QC and reviews with access for the inventory team members at Statistics Finland but only the coordinator and her deputy can make changes to the folder. The folder "GHG calculations" contains the data, calculations sheets and other reporting tools for the calculation of the inventory estimates for the energy and IPPU sectors which are calculated at Statistics Finland as well as related to compilation of the whole inventory. The folder "GHG inventory unit" contains mainly general documentation related to the inventory preparation such as descriptions of the national system and its administration, agreements, QA/QC documentation, inventory development plans and the draft of the annual national inventory reports. At the expert organisations, they are responsible for achiving information used for preparing the other sectoral estimates of GHG inventory, e.g. calculation sheets, models, databases and references. Archiving quality of the expert organisations are controlled by the Statistics Finland. The experts organisations have provided their archiving plans to Statistics Finalnd and they fill in annually information on the implementation of the plan in QA/QC templates, which cover also other aspects of inventory preparation. Based on these

templates, Statistics Finland assesses and discusses as necessary the implementation and need for changes in the archiving with the organisations during the annual quality meetings.

Based on the experiences of Finland, suggestions on archive system are made. The Party should consider designating an archiving coordinator, developing an archive plan with defined responsibilities and tasks on archiving for each inventory team member. The plan should specify details of the archiving system (what, where, when, how). Relevant templates and checklists [25] should be prepared in order to ensure that the plan is followed in an appropriate manner. The Party should assess and revise the plan and procedures periodically for continuous improvements and provide access to the to archived materials through one focal point/single location. Slide 14

2.10. National inventory arrangements of Brazil

Newton Paciornik

Brazil recently submitted its 2nd national communication at the COP 16 in November 2010[26]. Besides GHG inventory, the 2nd national communication also includes national programmes to implement the UNFCCC and other information such as transfer of technologies, research and systematic observation, education and training, capacity building and information, and networking. Brazil had made an effort to provide information on GHG inventory beyond what was required. To illustrate, for its initial national communication, Brazil produced time series of GHG emissions and removals from 1990 to 1994, while the guidelines required for 1990 or 1994. Similarly, for its 2nd national communication the GHG inventory provides GHG emissions and removals for the years from 1990 to 2005, though the guidelines required year 2000. Such extra efforts were made on the GHG inventory in order to raise public awareness and provide information useful for policy implementation in addition to the commitment under the UNFCCC. Slide 2-4

Despite the progress, two issues regarding financial constraints that remain the prime obstacle to GHG inventory development. The first issue concerns the continuity of financing. Brazil, like other non-Annex I Parties, has relied greatly on the GEF financing for preparing the national communication and hence the GHG inventories. However, the GEF financing has been provided on a project-basis. Brazil henceforth had to dismantle the inventory team after the first national communication was completed, and re-structure the team when new financing was received for the second national communication project. This situation has obstructed the continuity of the operation and permanent positions for the inventory staff, which is a desirable feature, admitted Brazil in response to Sudan. In order to overcome this problem, Brazil submitted the project proposal for the 3rd national communication and concluded an agreement with the GEF well in advance to close the gap. Additionally, Brazil has also finalised an agreement with the United Nations Development Programme (UNDP) for creating at least three permanent staffs in its GHG inventory team. Slide 6-8

The second issue concerns the financing approach. To illustrate, for its 2nd national communication Brazil received financing from GEF in 2003 in USD. However during the preparation of the inventory, after all the contracts have been made with the external experts for each sector (in Real, the Brazilian currency), the exchange rate changed from 3.5 to 1.7 Real for one USD. The new exchange rate translated to less money received in local currency, thus causing financial difficulties to carry out the planned tasks for the GHG inventory.

[25] Statistics Finland developed a template and checklist for archive based on the EPA template and Finland's experiences. The template can be shared upon request.

[26] Available at www.mct.gov.br/clima

Slide 5-12

Brazil's institutional arrangements for preparing the national GHG inventory include a General Coordination and Sectoral Coordinating Entities. The Ministry of Science and Technology, who has the responsibility for coordinating the implementation of the UNFCCC, is in charge of the General Coordination for the national GHG inventory. He provides methodological support, QC, in-house complementing studies, data management and archiving. The actual compilation is divided by sector: energy, agriculture, LUCF, waste and IPPU. There is a Sectoral Coordinating Entity in charge of each sector, except for the industrial processes sector, where coordination was established by category. The entity is responsible for calculating emissions and removals and preparing background reports [27] to enhance transparency. Generally, the entities engage experts from universities, research institutes, government agencies and NGOs. It should be noted that the arrangements have improved when compared to the initial national communication. For the 2nd national communication, Brazil had more institutions and experts involved in the development of national GHG inventory. The 2nd national communication received contributions from over 600 different institutions and 1,200 experts, compared to 150 institutions and 700 experts during the development of the initial national communication.

Brazil has implemented a number of adjustments to its institutional arrangements for the GHG inventories in order to address the financial issue. The initial national contribution established to be USD 4.2 million had to be raised to USD 7.2 million including additional funds from the Ministry of Science and Technology and several partner institutions. Some planned activities had to be reviewed. One example was the QA activity that had to rely on the extensive use of public review in order to lower the use of external consultants. Despite the efforts, without the sufficient coverage of the entire expenditure in the future, the financial problems are foreseeable for the development of Brazil's 3rd national communication since remotely sensed images at the adequate resolution may not be available and may need to be acquired from other sources. Presently, the Brazilian National Institute for Space Research (INPE) distributes all the satellite images from Landsat-5 and CBERS (The China-Brazil Earth Resources Satellite) freely on the internet. However, CBERS is not operating at present, and imagery may not be as available as during the first two previous national inventories. The use of remotely sensed data of adequate resolution, and the integration with other sources of information involves other costs, such as those for image processing and analysis, according to its response to Indonesia. The solution to this problem, as suggested by Brazil is to request support from GEF that would cover the actual financing needed.

Slide 13-14

Brazil conducted the national GHG inventory based on the following IPCC Guidelines: 1996 Revised Guidelines, GPG 2000, GPG for LULUCF 2003 as requested or encouraged by the UNFCCC, including information from the 2006 Guidelines that could better apply to its national circumstances. As for the UNFCCC Guidelines, Brazil does not agree with the concept of using the metric GWP-100 years for presenting emissions in CO2e. The GWP is not an appropriate measure to compare gases in relation to climate change damage because the approach overestimates the contribution of the short-lived gases, such as methane. Moreover, as long as the GHG emissions and removals of individual gases are transparently presented in mass units, all the necessary information for calculating emissions in CO2e is available. In addition Brazil included in its 2nd national communication and information box showing the implication of using different equivalence metrics.

As for the LULUCF sector, a non-profit Foundation for Science, Application and Space Technologies - FUNCATE has been the coordinating institution. It is responsible for the overall work, including contributions from the Ministry of Environment, National Statistics Institute, National Institute for Amazonia Research, University of Sao Paulo, Ministry of Agriculture, and Pulp and Paper Association. The LULUCF sector is the sector that contributes the most to the total national

[27] For the GHG inventory presented in the 2nd national communication, Brazil prepared 18 background documents to be published online in due course. At the moment, they are being translated into English and Spanish

GHG emissions and this was one of the reasons for Brazil to apply the more complex approaches and methodologies in the IPCC GPG for LULUCF 2003. To estimate anthropogenic emissions and removals from the LULUCF sector, the entire territory of Brazil was stratified into 7.5 million spatially explicit polygons created from the integration of several information layers (land-use in 1994, land-use in 2002, biome type, original vegetation, soil type, municipalities). This allowed net estimates to be produced for the different land-use transitions in a very detailed way, generating emission estimates per biome, per municipality and per land-use category, as well as for the entire national territory.

2.11. National inventory arrangements of Gabon

Rodrigue Abourou and Leatitia Magoulou

The issue of climate change is included into Gabon's national environmental code. The Party created National Council on Climate Change in April 2010 with the goal to establish a national plan for climate change. Gabon submitted initial national communication in 2003. The development of the 2nd national communication is in progress and expected to be completed by June 2011. It is worthwhile to note that the development of national communications is a learning progress. Gabon has made improvements to the 2nd national communication based on experiences gained from preparing the initial national communication. The Prime Minister Decree on National System has a considerable role in shaping the institutional arrangements for the national communication and GHG inventories of Gabon. The decree links all involved entities together and ensure that the final output of the GHG inventory is shared with the National Climate Change Council in order to prepare the national plan for climate change. The institutional arrangements are nevertheless temporary. The arrangements last only when the communications are prepared. Main actors of the arrangements are the governmental agencies, private sector, GEF as the major financier and country counterpart as another source of finance. Slide 2-5

The arrangements are based on the following structure (Figure 9) . The National Steering Committee has the highest decision-making power. The Committee makes important decisions regarding the national communication, while other decisions can be made directly by the Coordinator. As a result of the Decree, the National Director is in charge of facilitating the implementation of the national communication. The Decree empowers him with an access to national statistical data, thus allowing such access for consultants preparing the GHG inventory upon their requests (letter to the National Director). His responsibilities are to coordinate with consultants and exchange data as well as expertise between different units through the national Coordinator. The Coordinator, Assistant and Archivist make up a team of national communication. They supervise different groups preparing the national communication. The Coordinator recruits experts for each group, handles their contracts, provides training programmes and selects team leaders, which are often times the consultants/experts selected. More importantly, the Coordinator is in charge of financing for all groups including the GHG inventory. Slide 6-7

The arrangements for the GHG inventory comprise different operational units for forestry, agriculture, energy and industry sectors. The units depend on corresponding governmental departments: Department of Water and Forest, Department of Agriculture, Department of Energy and Department of Industry and the Environment respectively. For each sector, external consultants also are one part of the team. Driven by the need to develop forest GHG inventory and eligibility of Forest Carbon Partnership Facility, scientific studies on forest carbon stocks were conducted with financial Slide 9-15

Fig. 9. Institutional arrangements of Gabon

support from Moore and Packard Foundation. For similar purpose, the agency for Observation and Spatial Studies was created to study the forest cover change, with technical support from Brazil. As regards information flow of the GHG inventory arrangements, the consultants share information with the team leader. The leader then report to the Coordinator. He then provides the information to the National Director.

Slide 17-18

In response to a question from Coalition for Rainforest Nations (CfRN), Gabon planned to establish a national system. However, the expenditure related to the establishment of the institutional arrangements for preparing GHG inventory was large. Financial constraint has been a barrier to the development of GHG inventory in Gabon. The estimated expenditure is shown in Table 1.

Activity	Expenditure of national GHG inventory (USD)
Management of the team	90,000
Training and capacity building	10,000
Data collection	85,000
QA/QC	10,000
Validation workshop	9,000
Total expenditure	204,000
2011 country counterpart finance	40,000

Table 1: Brief summary of some aspects identified as problematic in the National GHG Inventory System

Slide 18-19

Apart from financial constraints, Gabon has faced with other difficulties in developing the GHG inventory, primarily related to data. The lack of data, inadequate access to available data and inconsistency of obtained data led to problems with transparency, reproducibility and accuracy of the GHG estimates. On this remark, Finland suggested that the enhanced relationship with national statistical office might be a solution. Another suggestion from Malawi refers to the permanence of data collection team. In agreement with the suggestion, Gabon attempted to establish a permanent inventory team with responsibility for data collection. Besides data-related problems, local EFs are absent and archiving system remains incomplete. Entities with needed expertise and information are not involved in the present process of the GHG inventory development owing to the lack of awareness regarding the national GHG inventory.

Fig. 10. Institutional arrangements of Vietnam

2.12. National inventory arrangements of Vietnam

Nguyen Van Anh

Vietnam completed two national communications. The 2nd national communication (SNC) was submitted to the UNFCCC Secretariat at the COP 16. It contains information on national GHG inventory in 2000, assessment of climate change impacts and recommendations for adaptation and mitigation in major economic sectors. Slide 2-3

To develop the SNC, Vietnam has established institutional arrangements as illustrated in Figure 10. The government of Vietnam assigned the Ministry of National Resources and Environment (MoNRE) to be a national focal point for implementing the UNFCCC and KP programmes and activities, with direct support from Vietnam National Steering Committee for UNFCCC and KP. The National Communication Team and National Technical Expert Team were responsible for producing the SNC. The Working Group on GHG inventory under the SNC was divided into five sub-groups by sector: energy, industrial processes, agriculture, LULUCF and waste, in accordance to the IPCC Guidelines. As regards REDD+, during the first quarter of 2011, the government of Vietnam aimed to establish a National Steering Committee for REDD+, which would be chaired by the Minister of Agriculture and Rural Development. Slide 4-6

In developing the national GHG inventory, Vietnam based on the IPCC 1996 Revised Guidelines. IPCC default EFs were used for most sectors, except some of agriculture and LULUCF, where the country-specific EFs were used. KCA was performed using Tier 1 methodology, resulting in 14 identified key categories. The Standing Office of the National Steering Committee for the UNFCCC and KP archived activity data and the national GHG inventory report in both electronic and hard copies and located at the Department of Meteorology, Hydrology and Climate Change (DMHCC) of the MoNRE. Slide 7-9

To provide high quality GHG inventory, Vietnam has encountered a number of limitations. Slide 21-22

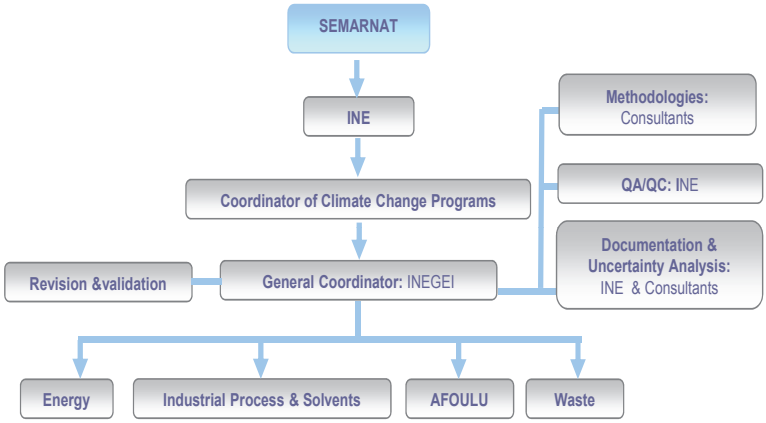


Fig. 11. Institutional arrangements of Mexico (1990-2006)

Primary concerns have centered on data availability. Activity data remains lacking in many areas, whilst data collection and data management systems are incomplete. On this remark, Finland suggested the Party to strengthen relationships with its national statistical office, as the office is likely to have necessary data. In response, Vietnam revealed that it has been solving the problem by employing external consultants to perform the data collection task. The lack of country-specific EFs, inadequate pool of technical experts and insufficient inter-agency coordination represent other areas of concern. To address the limitations, Vietnam recognised the need to develop activity data and country-specific EFs, to provide training and capacity-building programmes, to strengthen coordination between related agencies and to establish a national GHG inventory agency.

2.13. National inventory arrangements of Mexico

Carlos Zermeño & José Carlos Fernández

Slide 2 Mexico submitted 4 national communications to the UNFCCC Secretariat. The initial national communication was submitted in 1997, followed by the 2nd, 3rd and 4th in 2001, 2006 and 2009 respectively. At present, Mexico is preparing its 5th national communication. National GHG inventory is a part of the national communication.

Slide 3-12 Institutional arrangements for preparing the GHG inventory have undergone incremental adjustments over the years. The arrangements comprise main elements of the GHG inventory such as QC procedures, uncertainty analysis and documentation. External consultants were hired to perform QA procedures. The INE remains responsible for developing the national GHG inventory and coordinating national climate change programmes. Changes were made on the working groups. During 1990-2002, the arrangements included working groups for industry, solvent, agriculture, LULUCF and waste sectors. For the arrangements during 1990-2006, certain working groups were combined for greater coordination and accuracy.

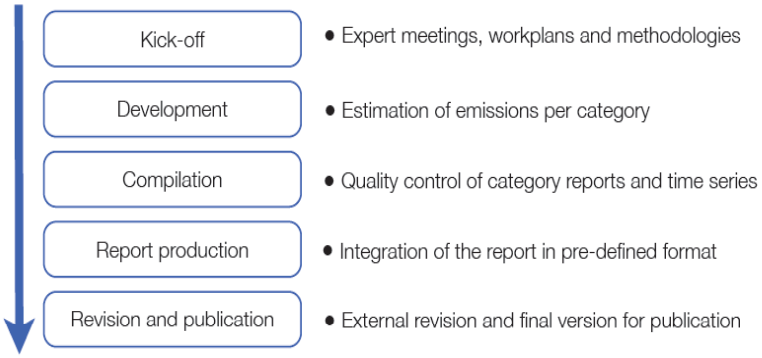


Fig. 12. Process of GHG inventory preparation

As illustrated in Figure 11, during 1996-2006 the external consultants generated guidelines to develop and update the GHG inventory, defined methodologies to apply and selected EFs for individual category. Together with the consultants, the INE prepared QA/QC plan, supervised QA/QC procedures application, prepared the text for the GHG inventory, codified and maintained paper and electronic archives, safeguarded documents and oversaw publication and distribution. Within each group (energy, industrial process and solvent, AFOLU and waste), there was a category coordinator with responsibilities to collect data, to supervise consultants, to prepare text to report per category, to apply QC procedures, to estimate uncertainties and to execute corrective actions to ensure quality.

The process of national GHG inventory preparation consists of 5 steps (Figure 12). Step 1, the kick-off consists of harmonising the data through a number of expert meetings. Step 2 is where the emissions per category are estimated. Data compilation as well as QC of each category occurs during Step 3. The process ends with report production (Step 4) and revision and publication of the final report (Step 5). Once published, the inventories are provided via web access[28]. Several other documents are used during these stages. They are the reference manual, consultation reports, methodological reports, QC reports, QA plan and NIIP, to name a few. Slide 13

For the LULUCF sector, the institutional arrangements are necessary as means to obtain activity data and EFs and to estimate the emissions from the sector. Data generation is at heart of the GHG inventory development since it is not possible to develop the inventory without basic data. Based on Mexico's experiences, gathering data requires most part of the funding. Mapping and obtaining satellite imagery are expensive. Apart from data generation, QC of the data should be focused. The efforts need to be made in an adequate manner to ensure high quality and sound data. Key contributors to the LULUCF data are National Institute of Statistics and Geography (INEGI), Conafor and Secretary of Environment and Natural Resources (Semarnat) (Figure 13). INEGI is responsible for mapping, which helps identify land-use changes and forest distribution at a national level. Conafor is in charge of monitoring land-use changes on an annual basis via remote sensing devices, which have played an important role in determining public policies for the sector. Also, Conafor is responsible for conducting NFI, which serves as a key data for formulising national forest policies. The NFI and remote sensing data are highly interrelated. Mexico cannot make decision on the remote sensing report without adequate information from NFI. Slide 23

Consistency of data for deforestation rate has been problematic. There exist discrepancies among different reports ranging from two million ha annually to 75 million ha. Reports on activity data of forest inventory had been conducted since 1960s until today. Each report however has different Slide 24

[28] Available at: www.ine.gob.mx/cpcc-lineas/597-cpcc-inventario

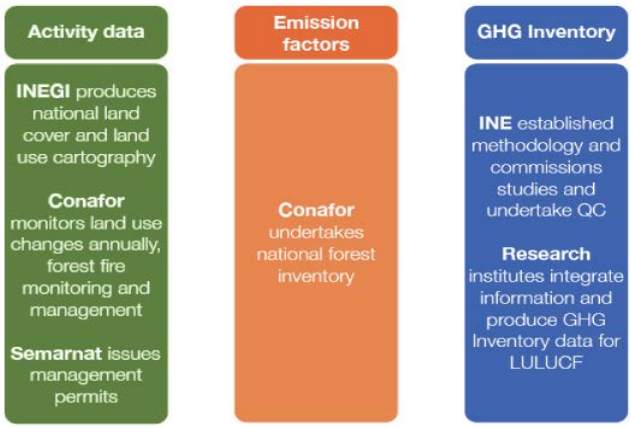


Fig. 13. LULUCF arrangements

baselines, benchmarks, categories and objectives and has used different technologies. The difference in scale of the reports has made them incomparable. The reports however allow Mexico to produce GHG inventory and time-series data, which enable the Party to compare the data what we produced in the 1960s and the data that is produce today.

Slide 25-28 Time series data is of the essence. Mexico invested its effort on mapping, which is comparable through time. The National Statistics Institute is responsible for the mapping and the institute also continuously uses the same scale over time. This greatly reduces the uncertainty of the data. This data obtained was used not only for producing the GHG inventory but also for the NFI and soil inventories. Mexico carries out forest assessments for the entire country every five years and 20% of the sites are revisited each year. The assessments are submitted to the FAO. Mexico also uses this method to calibrate its satellite imagery, which it began in 2004. Mexico uses modest technologies, vegetation indices and soil use changes on an annual basis. Over the next few years, the INEGI will put together a series of five reports and will continue to use this method to gradually integrate and synchronise the dataset for the LULUCF sector.

Mexico also has data on carbon flux, biomass reservoir and soil. These are quantified through information gathered from soil inventories for example and through different institutions. Such information is crucial for developing GHG inventory for LULUCF sector.

Slide 33 To develop these communications, Mexico invested a large sum of financial resources: about USD 1.75 million for its 3rd communication and about USD 2.75 million for its 4th communication (excluding costs of key inputs, e.g. NFI and land cover maps). Apart from financial resources, Mexico has made regulatory and institutional adjustments within the environment Secretariat. As a result of the adjustments, the National Institute of Ecology (INE) is assigned with overall responsibility for developing the national communication. The responsibility includes coordinating among the involved agencies, collecting data, improving and systematising the national GHG inventories in a permanent manner. Despite the improvement, the existing challenges of Mexico are:

- The need to improve level of communication and relationships between different institutions with the necessary data or capacity to generate them;
- The need to increase capacity of the government agencies in order to foster communication and smooth information flow;
- The need to improve QA/QC and quality of data particularly in forest management; and
- The need to enhance coordination between GHG inventory and REDD+ reporting.

There are two major lessons learned from Mexico's experiences, including the NFI model and

institutional arrangements. The traditional model of NFI, where the GHG inventory is conducted twice at different point of time in order to compare the change, e.g. a 10-year gap. The model is regarded as inefficient for REDD. The Mexican model on the other hand is appropriate for both reporting for the UNFCCC and the REDD. To illustrate, Mexico conducts the NFI for the entire country every five years and 20% of the sites are sampled randomly distributing into all types of ecosystem every year. By doing so, even if it is only a certain percentage of the sites, Mexico can incorporate the data for variable time.

Another issue refers to the importance of the institutional arrangements. The arrangements were not present in the past since the institutions responsible for mapping and institutions responsible for developing the NFI or other data did not coordinate. Important data was not synchronised and not sufficiently updated. Now that the INEGI, Semarnat and Conafor are coordinating, as a result, Mexico has a calibrated data available approximately at the same time that can then being integrated into the National Institute for Information.

3. Questionnaire results

This chapter discusses information collected from questionnaires which were distributed to participating countries prior to the workshop and were completed by 35 non-Annex I Parties [29]. The objectives of the questionnaire were:

(a) To assess current status and practices of national GHG inventory development with the focus on the AFOLU sector; and

(b) To identify needs and potential constraints in developing the GHG inventory.

The questionnaires are analysed according to the main building blocks of the national GHG inventory development as the following [30]: (1) GHG inventory team, (2) institutional arrangements, (3) resources, (4) software development, (5) archiving system, (6) publication, (7) key category analysis and (8) inventory development cycle. Additionally, the questionnaire also covers the issue of current problems encountered during the national GHG inventory preparation for the AFOLU and other sectors. The analyses will be used by the organising agencies to plan and implement their activities on capacity building.

3.1. GHG inventory team

The important characteristics of the GHG inventory team that were addressed are the permanence of the GHG inventory team and involvement of external experts and institutions. The complete set of answers related to this topic is provided in Appendix 1.

3.1.1. Permanence of the GHG inventory team

Non-Annex I Parties will be required to report national GHG inventories on a more frequent basis than they do currently, as envisaged by the Cancun Agreements. The requirement for a biennial reporting provides an impetus for maintaining a permanent institutional capacity for GHG inventory preparation, rather than a reliance on temporary, ad-hoc teams. To enable continuous GHG inventory planning, improvement and capacity building and to ensure that technical expertise and experience is retained, a permanent GHG inventory team with permanent staff positions should be created.

In response to the question "In your country, has an operational unit been established with a clear mandate for the preparation of the national GHG inventory?" 60% of the Parties that completed the questionnaire already established a GHG inventory unit, whereas 40% of the Parties did not.

Out of those Parties with the GHG inventory unit (figure 14), the majority (54%) has established the unit on a non-permanent basis. The non-permanent status of the unit could be further divided into indecisive (31%) and temporary status (23%). For example, Namibia has yet to define the status, as the GHG inventory unit has not been established. In Gabon, the GHG inventory unit has been provisional, renewed upon the preparation of the national communications. On the other hand,

[29] Argentina, Bangladesh, Botswana, Burundi, Cambodia, Central African Republic, Chad, Colombia, Costa Rica, Ecuador, Equatorial Guinea, Gabon, Ghana, Guatemala, Guyana, Indonesia, Kenya, Liberia, Malawi, Mexico, Namibia, Nepal, Nigeria, Papua New Guinea, Philippines, Republic of Congo, Rwanda, Sao Tome and Prï¿ncipe, South Africa, Sri Lanka, Sudan, Suriname, Thailand, Vietnam and Zambia

[30] Questions on QA/QC activities are included in the questionnaire. However, due to limited number of answers received, the topic is not included in the analysis

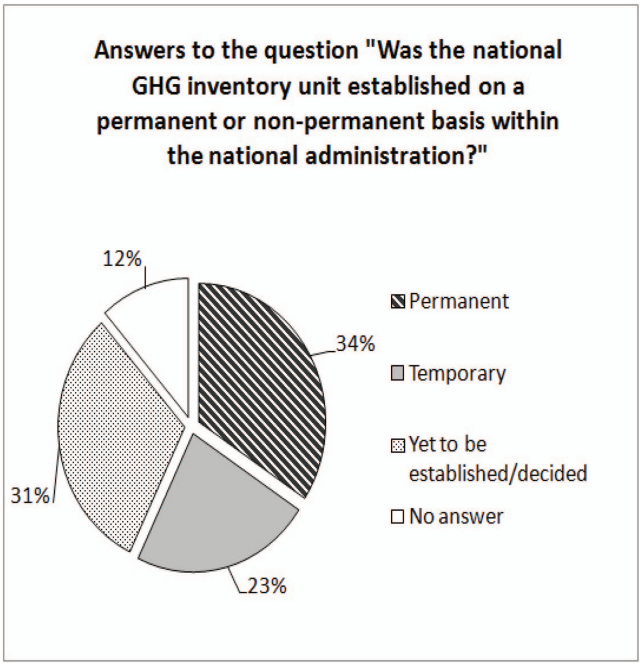


Fig. 14. Permanence of the GHG inventory unit

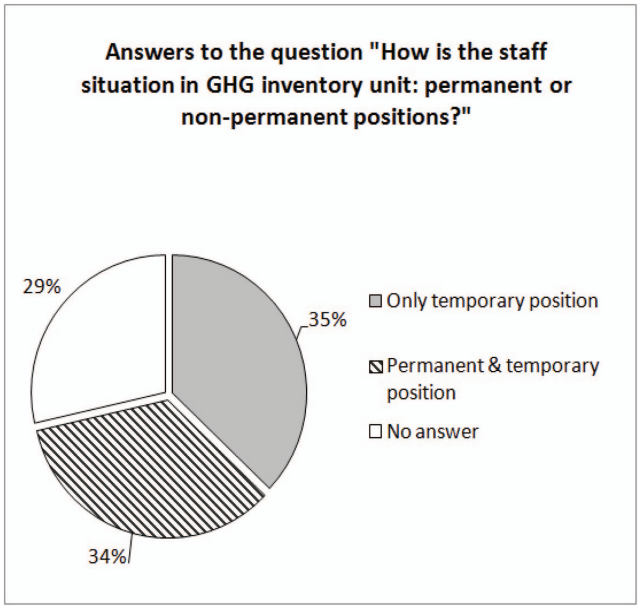


Fig. 15. Permanence of staff positions for the national GHG inventory

35% of the Parties have a permanent GHG inventory unit. Most of those Parties with a permanent unit reported hiring a few permanent staffs, ranging from one staff in Papua New Guinea to five staffs in Costa Rica.

Figure 15 shows that there is almost an equal number of Parties with only temporary staffs (35%) and with both permanent and temporary staffs (34%) for the GHG inventory unit. Parties with a non-permanent GHG unit usually have recourse to consultants that own the property of dataset used for preparing the GHG estimates. Malawi for instance does not have a permanent GHG inventory

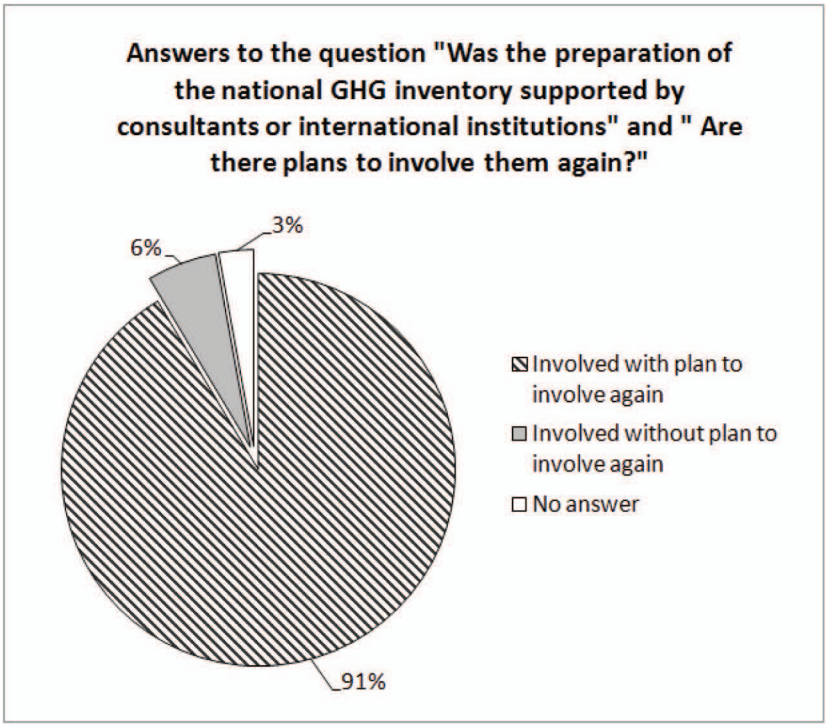


Fig. 16. Involvement of consultants and international institutions during the preparation of national GHG inventory

unit as the status of the unit remains under consideration. Malawi thus hired consultants on a temporary basis to conduct the entire inventory via GEF funding. Similarly, Nepal and Sri Lanka with temporary GHG inventory unit also contracted experts to prepare the GHG inventory.

3.1.2. Involvement of consultants and international institutions

Involvement of independent consultants and international institutions - entities external to the national administration - has been observable and proven beneficial for many non-Annex I Parties in preparing the national GHG inventories owing to the entities' technical expertise and financial support. Over-reliance on the other hand could limit the effort to build capacity within the administration, hence posing risks for the ability to develop national GHG inventories on the regular basis.

that appears under the Figure itself. This text is often very long and complicated, and is only useful when you've got the Figure sitting right there in front of you. It won't mean much to anyone just reading the List of Figures.

Figure 16 shows that 91% of the Parties, who completed the questionnaire, received support from external entities. It was mostly financial support, followed by technical support. Furthermore, all Parties except Nigeria and Zambia expressed an intention to involve the consultants and international institutions again for the next GHG inventory development, reflecting to a great extent the reliance on them to prepare the GHG inventory.

Many Parties reported the use of financial support from the GEF to contract experts for developing national GHG inventories rather than to build institutional, technical and human capacity of the GHG inventory team. To certain extent this owes to the limitation of the funding use. The funding could not be used to finance permanent staffs involved in public administration, hence

leaving little incentive for the Parties to improve numbers of permanent staff or to build capacity within the Administration. Consequently, a number of Parties voiced the insufficient IA, staffs and skills to conduct GHG inventory on a continuous basis.

Upon realising disadvantages of over-reliance on the external entities, a few Parties aimed to reduce it. For example, South Africa contracted independent consultants to compile the GHG inventory for LULUCF sector as well as the NFI, without resulting in building capacity within the Administration. Recently, the Party recognised the need to build up a skillful, permanent GHG inventory team, hence setting up programmes to build capacity for relevant ministries and departments within the Administration. Similarly, Ecuador, who previously relied on consultants for its national GHG inventory, expressed its intention to create and retain skills within the GHG inventory unit, while avoiding the use of consultants. Ultimately, having a permanent GHG inventory unit helps ensure the sustainability and continuity of the national GHG inventory development process.

3.2. Institutional arrangements

The important components of the IA that were addressed are: the existence of relevant institutions and relationship between institutions. The complete set of answers related to this topic is provided in Appendix 2.

3.2.1. Existence of relevant institutions

To conduct the national GHG inventory in the context of REDD+, the existence of relevant institutions - agriculture statistics unit, forest inventory unit, GHG inventory unit, REDD+ coordination and UNFCCC focal point - are of the essence. Each institution should be established with a clear mandate for the roles necessary for preparing the national GHG inventory.

The answers to the question "In your country, has an operation unit been established with a clear mandate for the collection of the agriculture data?" suggest that 74% of the Parties that completed the questionnaire already have an agriculture unit. According to the replies to the question "In your country, has an operation unit been established with a clear mandate for the preparation of the forest inventory?" the majority of the Parties (66%) has a forest inventory unit. Thirty-four percent of them, on the other hand, do not have the unit, thus hiring consultants to perform NFI on a project basis, e.g. Central Africa and South Africa.

In response to the question "In your country, has an operation unit been established with a clear mandate for the preparation of the GHG inventory?" the results show that the majority of the Parties (60%) has a GHG inventory unit with a mandate to prepare the national GHG inventory. Furthermore, almost half of those Parties currently without the unit are planning to establish it in the near future. Most Parties have the climate change office (74%) and already identified the REDD+ coordination (83%) according to the answers to the questions "In your country, has an operational climate change office or climate unit been established?" and "What is the national authority with a mandate for REDD+ issues?" respectively (Figure 17).

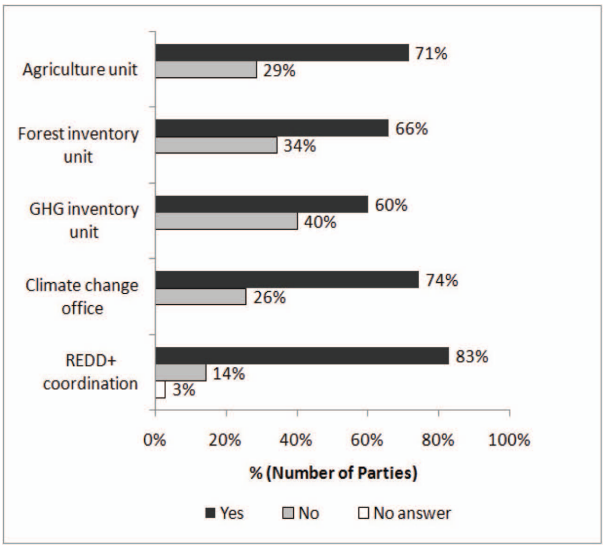


Fig. 17. Establishment of relevant institutions for the national GHG inventory

3.2.2. Relationship between institutions

Links among the units (national GHG inventory, forest inventory and agriculture units), UNFCCC focal point and REDD+ coordination are crucial. Whilst work of the GHG inventory unit relies on the data provided by the forestry and agriculture units, the UNFCCC focal point and the REDD+ coordination are also reliant on the data from GHG inventory unit to implement policies and mitigation actions for the AFOLU sector (Figure 18). Clearly assigned responsibilities and coordination are thus necessary in order to ensure smooth preparation of the national GHG inventory and to enable the UNFCCC focal point and the REDD+ coordination to implement policies and actions corresponding to local circumstances.

About the relationships between the units, the question was "What is the relationship among the national GHG inventory unit, forest inventory unit and agriculture statistics unit in terms of functional relationship, administrative relationship and decision-making autonomy?" Over half of the Parties (57%) revealed direct relationship among the units. Primarily the relationship is in form of functional relationship, where data and information flow from the forest inventory and agriculture units to the GHG inventory unit. For example, the forest inventory and agriculture units in Guatemala are responsible for collecting relevant information and report to the GHG inventory unit, where the integrity and consistency of data are thoroughly checked and used. This is followed by administrative relationship in form of decision-making authority, where the GHG inventory unit has such authority over the two units. On the other hand, some of the Parties (20%) described the lack of direct relationship (Figure 18). Generally, this is because the GHG inventory unit has not been established, hence the relationship remains undetermined.

According to answers to the question "What is the relationship between the GHG inventory unit and the UNFCCC focal point in terms of functional and administrative relationship?" over half of non-Annex I Parties (60%) reported the existence of direct relationship (Figure 18). Generally, the relationship is in form of functional relationship (reporting information to the UNFCCC focal point), followed by administrative relationship (the UNFCCC focal point has a decision-making authority over the GHG inventory unit). For example, the GHG inventory unit in Indonesia receives data from sectoral units, including forest inventory and agriculture units to prepare the national GHG inventory. Upon the completion of the national GHG inventory, the unit reports the information

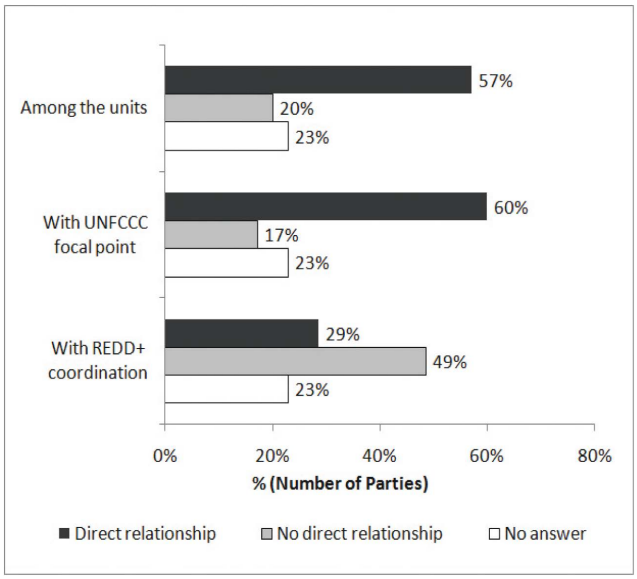


Fig. 18. Institutional relationship among the national GHG inventory unit, forest inventory unit and agriculture statistics unit

compiled to the UNFCCC focal point. In return, the focal point provides feedback of the GHG inventory to the sectoral units. Another example is Nepal, where the UNFCCC focal point has decision-making authority over the GHG inventory unit. On the other hand, 17% of the Parties lack of direct relationship between the GHG inventory unit and the UNFCCC focal point.

The answers for the question "What is the relationship between the GHG inventory unit and the REDD+ coordination in terms of functional and administrative relationship?" reveal that almost 50% of the Parties lack of direct relationship. Such lack, as some Parties explained, roots from the inexistence of REDD+ coordination and/or the GHG inventory unit. Almost 30% of the Parties disclosed direct relationship between the GHG inventory unit and the REDD+ coordination - generally in form of shared expertise and information (Figure 18). For example, in Costa Rica the LULUCF sectoral leader of the GHG inventory unit is part of the REDD+ coordination, vice versa. Hence, the REDD+ coordination and the LULUCF sector of the GHG inventory unit share both experts and information.

3.3. Resources

The important components of the resources that were addressed are: financial and human resources. The complete set of answers related to this topic is provided in Appendix 3.

3.3.1. Financial resources

Lingering global economic uncertainty and funding shortages further heighten the concerns over financial stability to support the development of national GHG inventory in many countries. Without sustainable financial resources to cover the expenditure necessary, the continuity of the GHG inventory development as well as capacity building of the inventory team cannot be realised.

Answers to the question "Do the national GHG inventory unit, agriculture unit and forest inven-

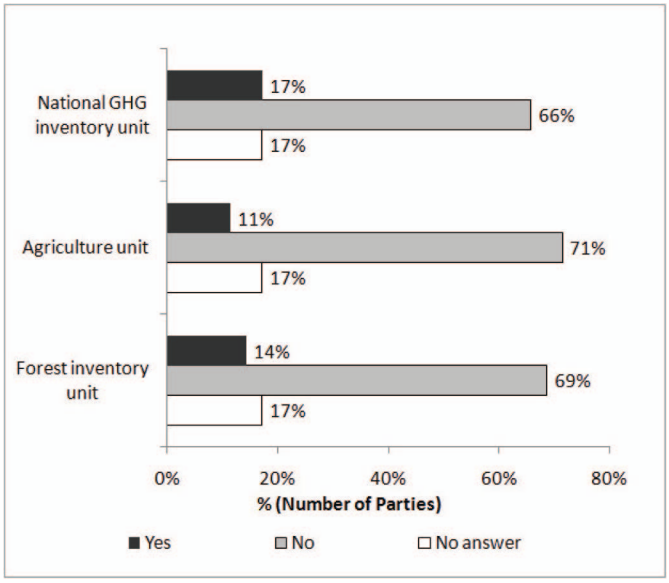


Fig. 19. Financial resources available for the national GHG inventory, based on the answers to the question "Do the units have budget dedicated for the GHG inventory development?

tory unit have budget dedicated to GHG inventory development?" revealed that the GHG inventory unit of the majority of Parties (66%) that completed the questionnaire answered no; they do not have budget dedicated for the GHG inventory purpose. Generally, the financial resources used for previous or on-going development of national GHG inventory come from international support for national communication on a project basis. For example, Thailand received funding from the GEF for its 2nd national communication. Yet, the portion of the fund allocated for GHG inventory preparation was not enough, hence was supplemented by other sources.

Recognising the need for sustainable financial resources Nepal, one of the Parties with GEF support, attempted to secure a permanent/long-term budget for its GHG inventory preparation. For similar reasons, the MoNRE of Vietnam has considered approving the national budget to implement the GHG inventory. On the other hand, 17% of the Parties already have the budget dedicated for the national GHG inventory e.g. Indonesia (Figure 19).

Concerning budget of the agriculture unit, most of the Parties (71%) answered no; their unit does not have budget dedicated for national GHG inventory preparation. The funding generally comes from international support that has been available on a project-basis. For example, Central Africa, Guatemala and Guyana noted that the funding comes from the GEF for the national communication development project. On the other hand, the unit in 11% of the Parties has the budget dedicated for national GHG inventory preparation (Figure 19). Namibia, for example, explained that there is a ministerial budget allocated to the unit for the GHG inventory purpose.

Regarding budget of the forest inventory unit, the majority of the Parties (69%) replied no; their unit did not have such budget available. Rather, the budget is generally dependent on international support on a project-basis. For example, Equatorial Guinea revealed that the latest forest inventory was funded by the FAO. Likewise, Ghana reported that the financial resource was allocated from the GEF funding for its national communication. Nonetheless, 14% of the Parties report the existence of budget dedicated for the purpose (Figure 19). One of those Parties, Suriname, explained that the forest inventory unit has a dedicated budget allowing the unit to have permanent staffs. However the amount is rather limited and sometimes insufficient.

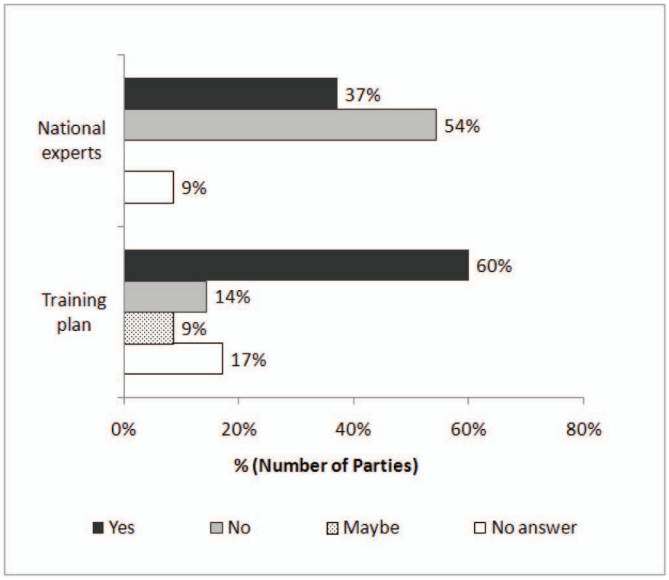


Fig. 20. Human resources available for the national GHG inventory, based on the answers to the question "Are the national experts within the national administration specialised enough to meet future GHG reporting requirement?" and "Are there plans to train additional employees for GHG inventories for the GHG inventory unit?"

3.3.2. Human resources

With regards to human resources, compiling a national GHG inventory requires the use of various GHG estimation methods and approaches as well as necessary data from a number of sectors. Human resources with sufficient technical capacity for data collection and inventory preparation will be necessary to meet the future requirement for reporting.

The answers to the question "Are the national GHG experts within the national administration specialised enough to meet future GHG reporting requirements?" were negative for the majority of Parties that completed the questionnaire (54%); their national experts are not specialised enough on the development of GHG inventory in order to meet future reporting requirements (Figure 20). For example, Kenya explained that its most recent GHG inventory was prepared over 10 years ago. Its national experts were thus not knowledgeable enough on the current estimation methodologies for GHG inventory development. Also, Guatemala voiced the need for capacity building activities of national experts in order to implement the IPCC 2006 Guidelines for GHG inventory.

On the other hand, 37% of the Parties replied yes, showing confidence that their national experts be specialised enough to meet future GHG reporting requirements. For example, Indonesia explained that it has a number of universities and research agencies working on related issues, thus those experts are well equipped to meet future GHG reporting requirements. Interestingly despite having sufficiently specialised experts to meet the requirements, Botswana did not assign those experts to the GHG inventory preparation on a continuous basis. Nine percent of the Parties did not answer (Figure 20).

To improve capacity of national experts, training programmes are the key. Answers to the question "Are there plans to train additional employees for GHG inventories for the national GHG inventory unit?" show that over half of the Parties (60%) plan to train additional employees for the national GHG inventory development (Figure 20). To realise the plans, some Parties engaged in bilateral cooperation. For example, Vietnam cooperates with Japan International Cooperation Agency, while

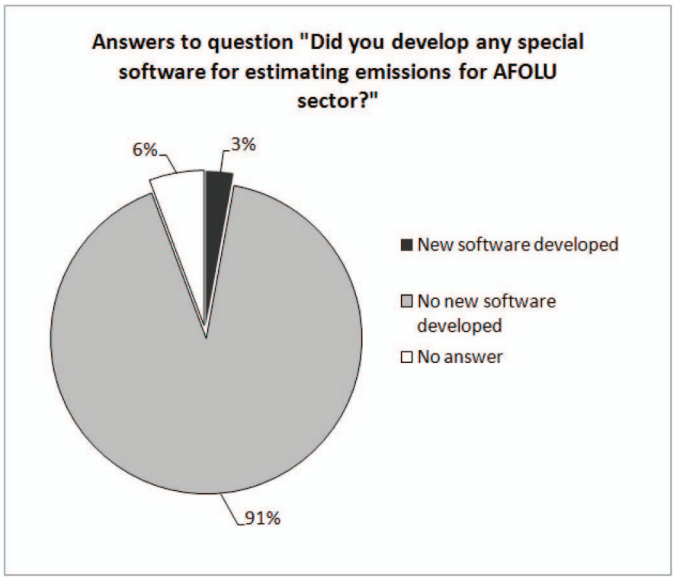


Fig. 21. Development of software for the national GHG inventory

Colombia collaborates with the Netherlands. Similarly, Malawi builds capacity of the GHG inventory team through a fellowship offered by the UNFCCC. Fourteen percent of the Parties on the other hand answered no; they do not have such plans. One of those Parties, Botswana, admitted that initially such training plans existed in order to respond to the inadequate training programmes at the national level. However global economic recession caused national financial shortage, hence the cancellation of the programmes. Nine percent of the Parties revealed the potential for conducting training programmes, yet such possibility is largely dependent on the availability of support. For example, Bangladesh and Ecuador expressed their willingness to train additional employees, if there is international support.

3.4. Software development

Currently, a number of software have been developed to provide technical assistance as means to improve data collection, monitoring and reporting of GHG estimates particularly from the AFOLU sector. Such software can be used for calculating national GHG emissions and removals and/or national or regional baseline for evaluating REDD+ projects.

As illustrated in Figure 21, the results show that 91% of the Parties that completed the questionnaire did not develop their own software for estimating GHG fluxes in the AFOLU sector. Nepal explained that the lack of financial support and skilled human resources has impeded the development of new software. On the other hand, South Africa developed a special tool to estimate GHG emissions from the agriculture sector. In response to the question "What type of software/tools have you used for estimating GHG emissions?" most of the Parties revealed the use of the UNFCCC software for estimating the emissions and removals (56%), followed by Excel tables (35%). Other software used are: LEAP model by Bangladesh; US EPA Templates and ALU software by Philippines and Papua New Guinea; and SQL Script and VBA code by Thailand. The complete set of answers related to this topic is provided in Appendix 4.

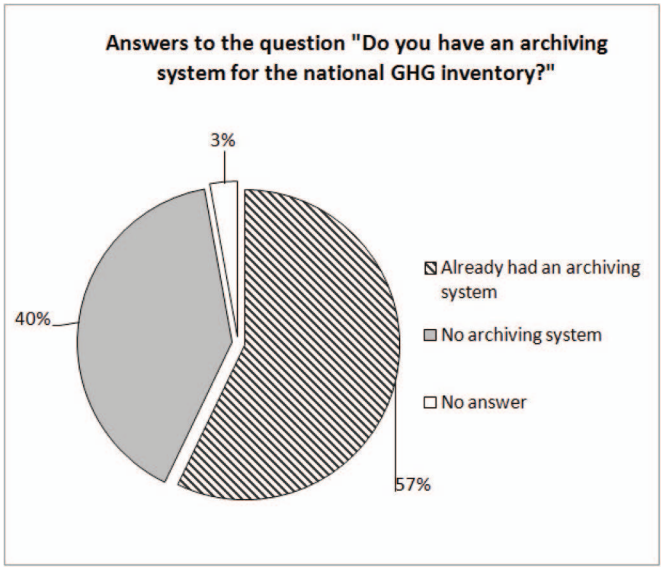


Fig. 22. Presence of archiving system for the national GHG inventory

3.5. Archiving system

The archiving system is a foundation for the preparation and development of subsequent inventories. The inventory team will benefit from effective data and document management of the previous inventories for each new GHG inventory cycle. The archiving system thus enhances transparency and ability to reproduce the national GHG inventory.

Fifty-seven percent of the Parties that completed the questionnaire have an archiving system (Figure 22). However many Parties noted that their archiving systems are not fully developed. For example, South Africa has an ad-hoc electronic archiving system, which was updated periodically. Out of those Parties with an archiving system, 70% of them have archives in both hard copy and electronic format. Twenty percent of the Parties have only hard copy archives, whereas 10% have only electronic archives (Figure 23). Botswana explained that electronic archiving system is not available in the country owing to the lack of information technology (IT) and skilled human resources. Cambodia on the other hand reasoned the absence of hard copy archives with limited human and institutional capacity.

On the other hand, 40% of the Parties do not have any archiving system (Figure 22). The Philippines, for example, noted that it does not have such system due to the lack of responsible institution/repository for archiving all the data and for future updating, whist Nepal reasoned the inexistence of archiving system with an inadequate technical and financial capacity. The complete set of answers related to this topic is provided in Appendix 5.

3.6. Publication

Publication of national GHG inventory helps enhance transparency of the inventory. The publication, particularly via website, allows the public to access the GHG inventory information. Furthermore, it can be used as means of direct communication with the public to further improve the GHG inventory and reduce the costs of external reviews by launching public reviews via the website.

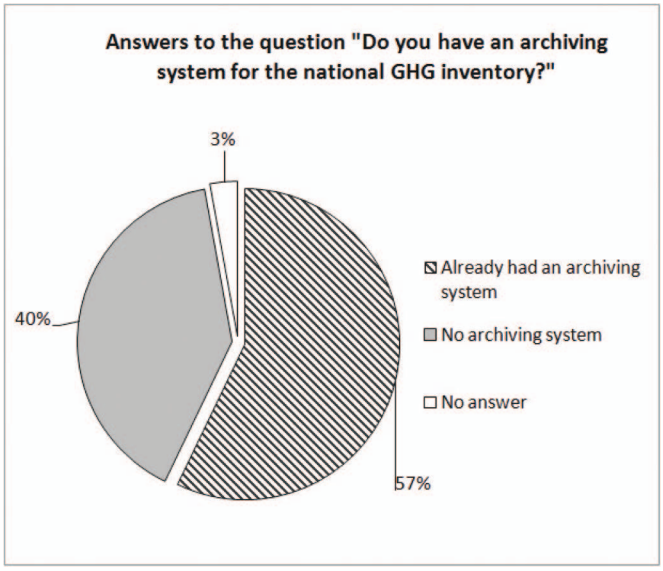


Fig. 23. Format of archiving system for the national GHG inventory

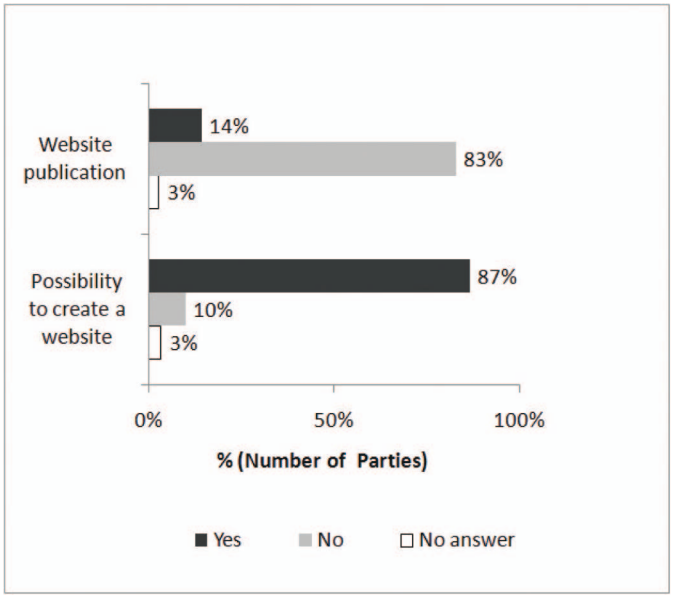


Fig. 24. Website publication, based on the answers to the questions " Does your country have a national GHG website with inventory information available on it?" and "If not, would it be possible to create one?"

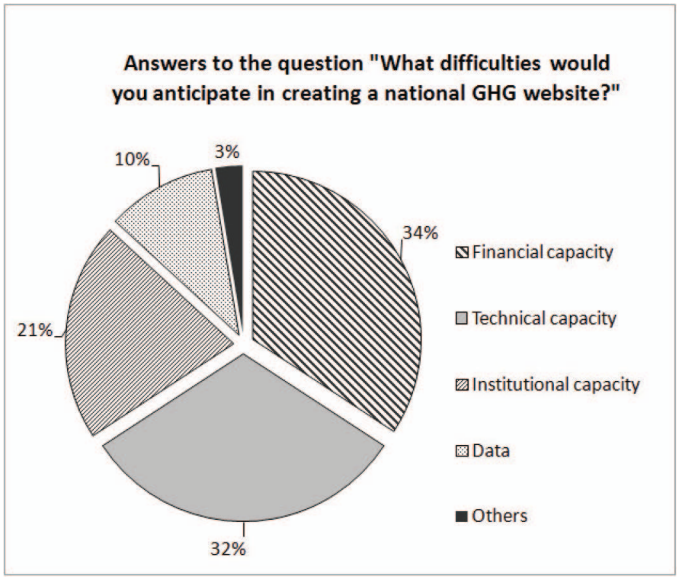


Fig. 25. Difficulties regarding creating a national GHG website

In response to the question "Does your country have a national GHG website with inventory information available on it?" 83% of the Parties that completed the questionnaire replied no; they do not have website available for publishing the national GHG inventory. Only 14% of the Parties have the website publication available. For the sub-questions "If not, would it be possible to create one? And what difficulties would you anticipate?" 10% of the Parties currently without such publication do not believe that it will be possible to create such website for their countries, whereas the 87% of them are optimistic. They believe that it is possible to create such website though with some difficulties (Figure 24).

The difficulties voiced generally concern with financial capacity, technical capacity, institutional capacity and data. As illustrated in Figure 25, primary constraint (33%) is the inadequate financial resources to fund the creation and maintenance of the website. Thirty-two percent of total replies indicated that the lack of technical capacity - skilled IT staffs and necessary IT equipments and facilities - has limited the ability of the Parties to build and maintain the website with updated information. Weak institutional capacity (21%), generally in the area of arrangements and coordination, was indicated as another area of concern. For example, Argentina and the Philippines did not designate any entity to perform the task whilst Nigeria had inadequate coordination between relevant institutions to realise the task. Other difficulties include language barriers. The complete set of answers related to this topic is provided in Appendix 6.

3.7. Inventory development cycle

The development of a national GHG inventory involves a number of steps to be taken and each step requires contribution from a wide range of institutions performing specific tasks. The steps should thus be planned with clearly specified timeframe, responsible persons and involved institutions. The schedule for GHG inventory development cycle allows the current and future GHG inventory teams to clearly communicate the commitments needed from responsible entities in order to complete the national inventory within the planned timeframe.

Forty percent of the Parties that completed the questionnaire already defined their GHG inventory development cycle with corresponding timeframe for each step as illustrated in Figure 26. The total

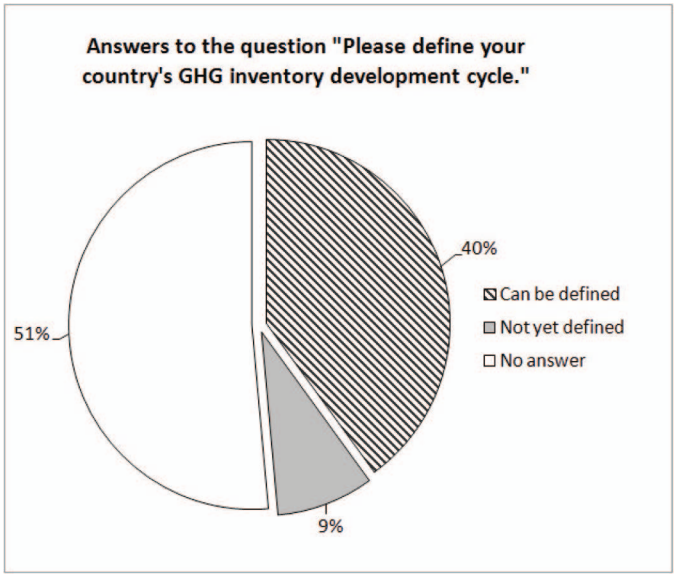


Fig. 26. Development cycle for GHG inventory

time spent for a cycle ranges from 8 months to 4 years. About 30% of those Parties however did not provide the timeframe. Nine percent of the Parties have not defined their cycle yet. For example, Botswana finds it difficult to describe the entire cycle, since there is no designated institution to define or manage the cycle and the institutions involved worked in isolation for the development of the GHG inventory. Most probably similar reasoning serves as an explanation for the Parties that did not answer. The complete set of answers related to this topic is provided in Appendix 7.

3.8. Key category analysis

KCA should be conducted within the national GHG inventory development since it helps identify key categories that have the most significant impacts to the total net GHG emissions and therefore helps prioritise areas to focus limited resources on. Key categories should be identified in a systematic and objective manner by quantitative analysis, qualitative analysis or both.

Forty-six percent of the Parties that completed the questionnaire conducted the KCA, as shown in Figure 27. Out of those Parties performing the KCA, 60% of them used only quantitative methods, while 40% of them used a combination of quantitative and qualitative methods. Of those who specifically reported the tier level used for quantitative analysis, all of them used Tier 1 method. On the other hand, 31% of the Parties that completed the questionnaire did not conduct the KCA. Main obstacles often voiced among the Parties are the lack of technical skills and the availability of data. For example, Sri Lanka and Botswana could not conduct KCA due to the inadequate skilled human resource. Similarly Rwanda explained that the complicated methodology combined with insufficient data has been the major barrier. However, it should be noted that for the Tier 1 quantitative analysis the estimates provided in the GHG inventory are the only data needed so the argument for the lack of data as barrier may potentially indicate insufficient skills/knowledge on the KCA. The complete set of answers related to this topic is provided in Appendix 8.

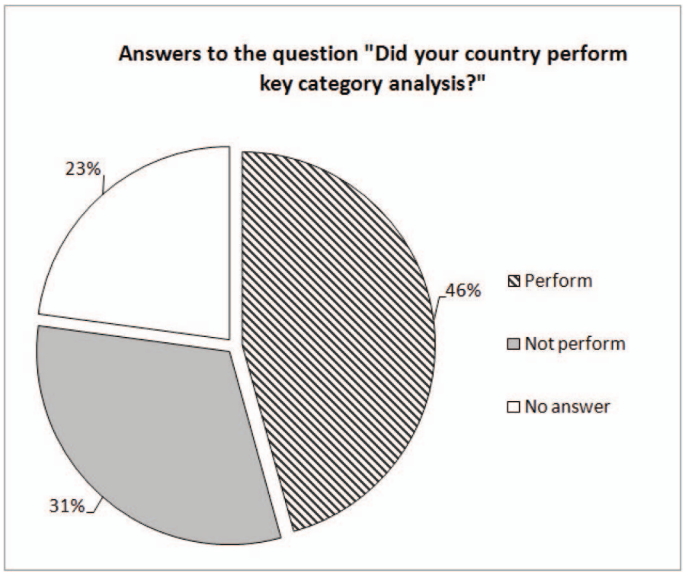


Fig. 27. Key category analysis performance

3.9. Current problems

Many Parties have encountered difficulties addressing some categories during the preparation of GHG inventories in the early years. Although enhanced experience and resources over the years helped improve accuracy of estimates from these sources, certain challenges remain in adhering the reporting requirements for the AFOLU sector and other sectors. The complete set of answers related to this topic is provided in Appendix 9.

Regarding problems in the AFOLU sector, the questionnaire asked the participants to "Please list down major problems, issues and concerns in the area of forest carbon stocks, land representation, forest fires and other carbon stocks".

In relation to forest carbon stocks, over half of the Parties that completed the questionnaire answered the dedicated question. Out of those answers, the issues of data availability and access for data were the prime concern (65%). For example, while Ghana lacked up-to-date NFI data, Central Africa voiced the lack of national data on fuel wood collection. Sri Lanka suggested that the lack of data availability generally roots from the absence of organised strategic framework and coordination, including insufficient human and financial resources to collect and manage data. For data access, Thailand for example voiced the need for access to data of private sector of forest industry (Figure 28). Inadequate technical capacity was another area of concern, representing 12% of the answers. For example, Republic of Congo expressed the insufficient technical capacity to estimate the forest carbon stocks. Eight percent of the Parties showed worries in the absence of national EFs. Owing to such absence, Zambia and Gabon usually used default EFs to estimate emissions and removals. Other concerns (12%) cover the lack of biomass expansion factor and the deficiency of forest monitoring system (Figure 28).

More than half of the Parties that completed the questionnaire answered the dedicated question on land representation. Almost half of the answers (49%) were related to data issues. Many Parties voiced the lack of land-use data (land cover map) and inadequate soil carbon data (soil type map) as major barriers. Thailand suggested that such lack of data, to a great extent, roots from the absence of mandate for relevant institutions to collect the data for the purpose of GHG inventory (Figure 28). Weak cooperation among the involved institutions represented 16% of total answers.

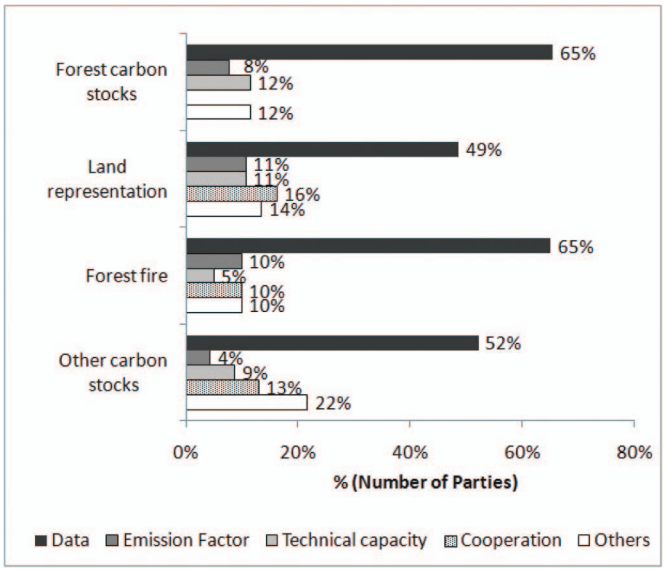


Fig. 28. Current problems of the development of GHG inventory in forest sector, based on the answers to the question "Please list down major problems, issues and concerns in the area of forest carbon stocks, land representation, forest fires and other carbon stocks."

Ghana revealed disconnection between sub-national and national level land representation schemes, while Nigeria reported the absence of GHG inventory coordinator and institutional arrangements as problems. Insufficient technical capacity was another problematic issue (11%). For example, Republic of Congo and Suriname voiced the absence of technical capacity to consistently monitor the land-use and forest cover data as an obstacle and Gabon reported that the tools for building land-use maps remains insufficient. Colombia explained that it has faced with difficulty in using the satellite images due to the lack of technology to deal with long periods of cloud cover. The lack of national EFs was vocal among 11% of all answers. Other concerns expressed by the Parties are inadequate financial resources, insufficiency of related legal arrangements and differences in land-use/land-cover definitions among datasets and IPCC classification.

Almost half of the Parties that completed the questionnaire responded to the dedicated question on forest fire. Out of these responses, major concern (65%) was about data availability and access to data of the private sector. For example, Central Africa voiced the lack of updated forest fire data owing to the uncontrolled slash-and-burn farming. Thailand encountered difficulties in attaining forest fire data in the areas owned by private sector. Ten percent of the answers were related to inadequate technical capacity. Argentina, for instance, needs more support on remote sensing technologies. Moreover, there were also concerns about the lack of national EFs (10%) and the absence of cooperation among the relevant institutions (5%). Other concerns included insufficient financial resources (Figure 28).

About half of the Parties that completed the questionnaire answered the dedicated question on other carbon stocks. Out of the answers, primary concern (52%) was about data. Gabon for instance noted on the absence of historical data for the past 20 years. Thirteen percent voiced the lack of synergy among the involved institutions. Another 9% of the answers showed worries in insufficient technical capacity. Four percent of the answers revealed the lack of national EFs as obstacles. Other concerns involved problems with private land, bush fire, financial shortage (Figure 28).

Apart from forest sector, over half of Parties that completed the questionnaire responded to the question - "Please list down major problems, issues and concerns in the area of other sectors".

The results suggest that primary problem encountered in other sectors involved the data issue

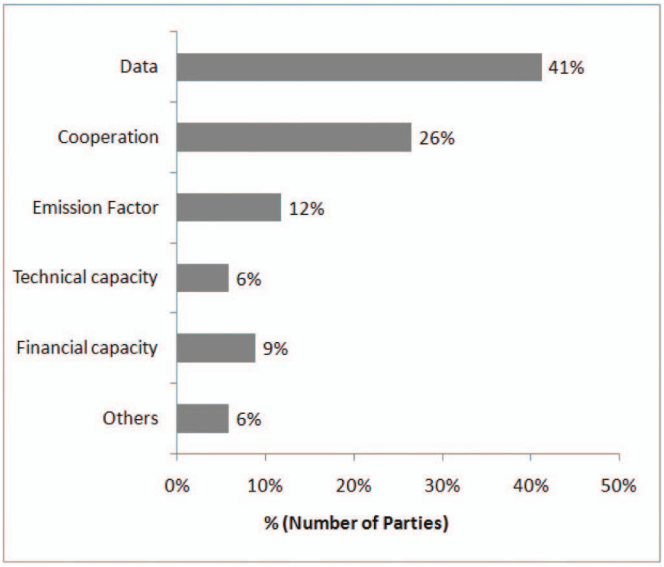


Fig. 29. Current problems in other sectors, based on the answers to the question "Please list down major problems, issues and concerns in the area of other sectors"

(41% in figure 29). Guatemala showed general concerns about data availability and access to information. Thailand on the other hand showed difficulties attaining data from private sectors owing to the lack of mandatory reporting obligation. Following the data issue, inadequate cooperation among the involved institutions was another major area of concern (26%). For example, Argentina explained that coordination between government institutions and private/public sector remained needed. The lack of national financial resource (9%) and technical capacity (6%) are also problems in many Parties. Other concerns are the absence of information management system, QA/QC procedures and archiving system (Figure 29).

4. Needs analysis and suggestions

To accommodate national circumstances, capabilities and capacities of different non-Annex I Parties, the current reporting requirements for these Parties are less stringent than those of Annex I Parties. The Parties are required to submit the national GHG inventory only within the national communication. Frequency, time-series, category disaggregation, gas coverage and the IPCC and UNFCCC reporting guidelines to be applied of the national GHG inventory of non-Annex I Parties vary greatly from those of Annex I Parties. There is thus little incentive for high quality reporting and continuous improvement towards TCCCA principle over time.

As envisaged by the Cancun Agreements, the UNFCCC reporting requirements for non-Annex I Parties are becoming more stringent: a national communication, including the national GHG inventory, every four years and an updated national GHG inventory every two years. Such requirements urge non-Annex I Parties to create a permanent national system for preparing the GHG inventory. The system, mirroring Article 5, paragraph 1 of the KP, should include institutional, legal and procedural arrangements for estimating anthropogenic GHG emissions by sources and removals by sinks. Moreover, in the context of REDD+, the development of a permanent and sustainable system for the national GHG inventory is crucial owing to the need to provide supplementary information to those contained in the AFOLU sector of the national GHG inventory. To do that, current constraints and/or needs of the non-Annex I Parties in preparing the national GHG inventories

should be addressed. The questionnaire answers, as discussed in Chapter 3, help in identifying the common needs, which are: institutional arrangements, data availability, technical capacity and financial resources.

4.1. Institutional arrangements

Unlike the strong coordination that existed among GHG inventory unit and agriculture statistical unit, national forest inventory unit and UNFCCC focal point, most of non-Annex I Parties lacked of direct relationship between GHG inventory unit and the REDD+ coordination. However, the implementation of REDD+ activities will require exchange of information between the national GHG inventory and the REDD+ coordination in form of supplementary information on anthropogenic GHG emissions and removals related to the REDD+ activities. Strong cooperation, hence direct relationship, between the GHG inventory unit and REDD+ coordination should thus be established to facilitate smooth operation of REDD+. Apart from REDD+ activities, the dependence on national GHG inventories will be a common theme of Parties with submissions on NAMAs. The national GHG inventories will be a fundamental element for establishing economy wide or sector specific reference level and for accounting for mitigation benefits generated by NAMAs. In other words the national GHG inventory, an instrument for assessing and evaluating GHG performances, is a vital component of a functional international finance mechanism for mitigation actions.

According to the Cancun Agreements [31], REDD+ focuses on forestry sector, providing financial compensations to slow and reverse forest cover and carbon loss based on mitigating actions. NAMA on the other hand support a broad set of mitigation actions, potentially including REDD+ activities, by developing countries. Given the common use of the national GHG inventory for all mitigation activities, the Party would benefit from establishing a Climate Change Committee (hereinafter 'the Committee') consisting of the head of GHG inventory unit, REDD+ coordination, NAMA authority and CDM Designated National Authority (DNA) and the representatives of relevant ministries. The Committee should be an entity established on a permanent basis, with a mandate to manage the national system for the GHG inventory. The President/Prime Minister or an officer representing his Cabinet, preferably the highest level in the Administration, should chair the Committee in order to ensure a strong authority, thus guaranteeing the required coordination and making available the resources needed (financial, technical and human resources) for the national system to perform its functions, e.g. data collection across different government agencies for preparing the national GHG inventories.

4.2. Technical capacity

Most non-Annex I Parties have limited technical capacity, reflecting in the lack of ability to collect data and estimate emissions and removals, to assess uncertainties, to conduct the KCA, to develop the archiving system and to publish and verify the national GHG inventory. The number of national experts is insufficient and in many Parties they are not specialised enough to meet new GHG inventory reporting requirements. Many Parties do not have a permanent GHG inventory unit established with permanent staffs to perform the technical work on a continuous basis. Henceforth, most Parties seek support from independent consultants on an ad-hoc basis and intend to use them again during the next GHG inventory development. Inadequate national capacity implies the need to build capacity and proper technical skills for the collection, processing and archiving of data for GHG inventories, potentially via national and/or regional programmes, as well as means to retain them on a long-term basis. The establishment of the permanent GHG inventory team, to which

[31] For more information, http://unfccc.int/files/meetings/cop_16/application/pdf/cop16_lca.pdf

proper and sufficient resources are allocated to materialise the preparation of the GHG inventory, could enable long-term inventory planning and retain technical expertise and experience. In other words, it helps ensure that technical skills and institutional memory will not be lost in between the GHG inventory development cycles. The useful initial step for creating the permanent team is to identify and recruit available national experts into the GHG inventory unit, followed by regularly training.

Training programmes are considered to be an inherent part of the GHG inventory process in many non-Annex I Parties and therefore should be carried out on a continuous basis in order to reduce the risk of high turnover of trained personnel and to strengthen the sustainability of the process. Such training and capacity building programmes could be performed via bilateral or regional cooperation, which could enhance efficient use of resources in overcoming similar difficulties in preparing AFOLU GHG inventory between countries such as activity data collection, insufficient receiving stations, persistent cloud-cover and seasonality issue. The cooperation should not be limited to project between Annex I and non-Annex I Parties. There is a great potential for some of the non-Annex I Parties with suitable existing capacities and long experience of conducting NFI or land cover monitoring, e.g. India, Brazil and Mexico, to engage in regional cooperation for capacity development.

Furthermore, a number of tools are available to provide technical support to the GHG inventory development process of the non-Annex I Parties. For example, the UNFCCC GHG inventory software, which facilitates the compilation and reporting of the GHG emissions via step-by-step approach. Also, it helps users to avoid potential mistakes and enhance transparency of the GHG inventory process. Similarly, the US EPA made freely available the ALU (Agriculture and Land-use) software for the GHG inventory of the AFOLU sector. The software facilitates the implementation of IPCC GPG in AFOLU sector, allows the users to move to Tier 2 approach, helps import Geographic Information System spatial data and produces spatially explicit estimates of biomass carbon stock changes in forest. Moreover, it improves transparency of the inventory development process as it eases the review of data input and assumptions and it has QA/QC feature in order to check data/assumptions [32]. Moreover, the US EPA provides a set of templates for developing the NIS for the GHG inventory by free web-based access. The six templates can be compiled into a single report, which provides comprehensive documentation of each of the critical building blocks of the national system for GHG inventories: KCA, institutional arrangements, documentation and category-by-category description, QA/QC, archiving system and national inventory improvement plan.

4.3. Data availability

Data issues represent a major constraint on the development of national GHG inventory for AFOLU sector in most non-Annex I Parties. Prime issues involve the cases where data are not available and where data are not accessible. The lack of data often roots from the absence of relevant, readily available and up-to-date national statistics, which reflects insufficient capacity of the national statistics system. Many Parties have inadequate resources for the collection, development and maintenance of important dataset such as NFI, land-use map and soil map. Access to available data in the country is also another limitation. The experts, who prepared the AFOLU GHG inventory, often have neither sufficient authority to request data from existing institutions, nor adequate coordination for data sharing with relevant institutions. Furthermore, external consultants who prepared sectoral GHG inventory tend to retain the ownership of datasets used in the GHG inventory preparation.

[32] For more information, http://www.epa.gov/climatechange/emissions/ghginventorycapacitybuilding/

To address the need for data that are not available, the Committee should set, subject to the availability of funds and technical expertise, additional monitoring activities with the aim to collect the needed data with proper quality and within a proper timeframe. For sustainability of the future GHG inventory preparation, a permanent process of data gathering should be established within the administrative structure of the main government agencies, enterprises as well as local governmental administrations. The process should incorporate confidentiality, verification and validation of data. The data-gathering task should become a part of their routine responsibilities, formalising the roles and responsibilities for data collection during the GHG inventory preparation between organisations involved. To provide access to data that are already available, the Committee should provide authority needed to gain access to data upon the request of the GHG inventory team or implement a legal basis for data sharing between the GHG inventory team and the entities in possession of data. Furthermore, the GHG inventory team should create close coordination with the national statistics office. Gaps in data collection should be identified and prioritised according to relevance of the source, e.g. contribution to total net GHG emissions. Strategies for gap filling and sustainability of data collection and management should be designed and implemented.

4.4. Financial resources

Insufficiency of domestic financial resources to support the GHG inventory development was reported in most non-Annex I Parties. Most Parties have thus relied on international support from the GEF for preparing GHG inventories as part of their national communication. Indeed, to comply with their obligation under Article 12, paragraph 1, developing country Parties receive financial assistance to prepare national communication from developed country Parties as required by the UNFCCC. Provision of this financing is tied to submission of national communications and conducted through the GEF [33].

It is worthwhile mentioning that in some cases, the GEF financing had not fully realised its objective. The GEF support aims to enhance capacity building and specific activities related to the preparation of national communications. Indeed, the financial support helped materialise the preparation of national GHG inventories in many Parties. However owing to the infrequent preparation of GHG inventories and the limitation in using GEF funds to pay permanent staffs, instead of building capacity some Parties have used the funding to hire staffs or independent experts for the preparation of national GHG inventory on a temporary basis. Without capacity/skills created and maintained from the use of GEF financing, such Parties would neither have ability to collect information and prepare estimates regularly. Particularly in light of more frequent reporting requirements, the Parties would have to rely on independent consultants and rebuild capacity for every following report rather than able to improve the reporting over time. In other words, such Parties would not be able to prepare the national GHG inventories unless the funding is provided.

In response to the more frequent reporting requirements, following the pledge made in the Copenhagen Accord, Annex I Parties reaffirmed the intention to provide up to USD 30 billion during 2010-2012 and to mobilise USD 100 billion per year by 2020 to support non-Annex I Parties by the Cancun Agreements. A portion of the financial support is likely to be dedicated towards helping non-Annex I Parties to report information on mitigation and adaptation more frequently and in a more detailed manner. The notion regarding additional funding to assist non-Annex I Parties to cope with new reporting requirements was further confirmed by the UNFCCC during the Workshop though the detail of the financial support remains to be clearly defined.

Despite the increase in international funding, non-Annex I Parties should attempt to lower the reliance on international support in a long-term in order to ensure the sustainability of national GHG inventory preparation. The Parties should maximise the international funding - donor coordination should be encouraged - while mobilising domestic funds. The development of long- and medium-term

[33]For more information, http://unfccc.int/national_reports/non-annex_i_natcom/items/2716.php

financial plans for the development of the GHG inventory should be conducted as means to maximise international support. The support should also be used in creating capacity for the GHG inventory team rather than hiring external experts on an ad-hoc basis without any skill transfer. At the same time, the Party should mobilise domestic funds by the market and non-market mechanisms for the implementation of its mitigation and adaptation actions in order to effectively improve and implement the GHG inventory on a continuous basis. Furthermore, the financial burden for preparing the GHG inventory should be shared when possible via cost-effective collaboration such as bilateral or regional approach to develop EFs for similar biogeographical regions[34].

[34]More details on this issue can be found in Appendix 10.

5. Appendices

5.1. Appendix 1: GHG inventory team

Parties	Permanent	Temporary	Yet to be established	NA
Argentina	X			
Bangladesh		X		
Botswana		X		
Burundi		X		
Cambodia	X			
Central Africa				X
Chad		X		
Colombia	X			
Costa Rica	X			
Ecuador	X			
Equatorial Guinea				X
Gabon		X		
Ghana	X			
Guatemala	X			
Guyana		X		
Indonesia	X			
Kenya				UN
Liberia	X			
Malawi			X	
Mexico	X			
Namibia			X	
Nepal		X		
Nigeria			X	
Philippines			X	
Papua New Guinea			X	
Republic of Congo			X	
Rwanda			X	
Sao Tome and Principe			X	
South Africa	X			
Sri Lanka			X	
Sudan			X	
Suriname		X		
Thailand	X			
Vietnam			X	
Zambia				X
Total	12	8	11	4

TABLE I
Data presented in Figure 14: Permanence of the GHG inventory unit

Parties	Only temporary position	Permanent or temporary position	NA
Argentina	X		
Bangladesh		X	
Botswana	X		
Burundi			X
Cambodia		4 perm. staffs	
Central Africa			X
Chad			unclear
Colombia		2 perm. staffs	
Costa Rica		5 perm. staffs	
Ecuador	X		
Equatorial Guinea	X		
Gabon	X		
Ghana			X
Guatemala		X	
Guyana		X	
Indonesia		X	
Kenya		X	
Liberia		X	
Malawi	X		
Mexico			X
Namibia	X		
Nepal	X		
Nigeria	X		
Philippines			X
Papua New Guinea		1 perm. staff	
Republic of Congo	X		
Rwanda	X		
Sao Tome and Principe	X		
South Africa		4 perm. staffs	
Sri Lanka	X		
Sudan			X
Suriname			Unclear
Thailand		4 perm. staffs	
Vietnam		4 perm. staffs	
Zambia			X
Total	13	13	9

TABLE II
DATA PRESENTED IN FIGURE 15: PERMANENCE OF STAFF POSITIONS FOR THE NATIONAL GHG INVENTORY

Parties	Involved with plans to involve	Involved without plans to involve	NA
Argentina	X		
Argentina	X		
Bangladesh	X		
Botswana	X		
Burundi	X		
Cambodia	X		
Central Africa	X		
Chad	X		
Colombia	X		
Costa Rica	X		
Ecuador	X		
Equatorial Guinea	X		
Gabon	X		
Ghana	X		
Guatemala	X		
Guyana	X		
Indonesia	X		
Kenya	X		
Liberia	X		
Malawi	X		
Mexico			X
Namibia	X		
Nepal	X		
Nigeria		X	
Philippines	X		
Papua New Guinea	X		
Republic of Congo	X		
Rwanda	X		
Sao Tome and Principe	X		
South Africa	X		
Sri Lanka	X		
Sudan	X		
Suriname	X		
Thailand	X		
Vietnam	X		
Zambia		X	
Total	32	2	1

TABLE III
DATA PRESENTED IN FIGURE 16: INVOLVEMENT OF CONSULTANTS AND INTERNATIONAL INSTITUTIONS DURING THE PREPARATION OF NATIONAL GHG INVENTORY

5.2. Appendix 2: Institutional arrangement

TABLE IV
DATA PRESENTED IN FIGURE 17: ESTABLISHMENT OF RELEVANT INSTITUTIONS FOR THE NATIONAL GHG INVENTORY

Parties	REDD+ authority	Clim. change office	GHG inv. unit	Forest inv. unit	Agric. unit
Argentina	X	X	X	X	X
Bangladesh	X	X	X		
Botswana					
Burundi	X		X		X
Cambodia	X	X	X	X	X
Central Africa	X	X			
Chad	NA	X			X
Colombia	X		X	X	X
Costa Rica	X	X	X		X
Ecuador	X	X	X	X	
Equatorial Guinea			X	X	X
Gabon	X	X	X	X	X
Ghana	X	X	X	X	X
Guatemala	X	X	X	X	X
Guyana	X	X		X	X
Indonesia	X	X	X	X	X
Kenya	X	X		X	X
Liberia	X	X	X	X	X
Malawi	X	X	X	X	X
Mexico	X	X	X	X	X
Namibia	X				
Nepal	X	X		X	X
Nigeria	X	X	X	X	X
Philippines	X	X	X	X	X
Papua New Guinea	X	X	X	X	X
Republic of Congo	X				
Rwanda				X	
Sao Tome and Principe					
South Africa		X	X		X
Sri Lanka	X	X	X		
Sudan	X	X			
Suriname	X	X		X	X
Thailand	X	X	X	X	X
Vietnam	X	X		X	X
Zambia	X			X	X
Total	29	26	21	23	25

TABLE V
DATA PRESENTED IN FIGURE 18: INSTITUTIONAL RELATIONSHIP AMONG THE NATIONAL GHG INVENTORY UNIT, FOREST INVENTORY UNIT AND AGRICULTURE STATISTICS UNIT

Parties	Among units	Between GHG inv. unit	Between GHG inv. unit and UNFCCC focal point
Argentina			X
Bangladesh	X	NA	X
Botswana	X	NA	NA
Burundi			
Cambodia	X	X	NA
Central Africa	NA		NA
Chad	NA	NA	NA
Colombia	X	X	X
Costa Rica	X	X	NA
Ecuador	X	NA	X
Equatorial Guinea	NA		NA
Gabon	X		X
Ghana	X	X	X
Guatemala	X	X	X
Guyana	X	X	X
Indonesia	X		X
Kenya		NA	X
Liberia	X		X
Malawi	X	X	X
Meico	X	NA	X
Namibia			
Nepal	X		X
Nigeria	NA	NA	X
Philippines	NA	NA	NA
Papua New Guinea	X	X	X
Republic of Congo	NA	X	X
Rwanda			
Sao Tome and Principe			
South Africa	X		X
Sri Lanka			
Sudan	NA		NA
Suriname	X		X
Thailand	X		X
Vietnam	X	X	X
Total	20	10	21
NA	7	8	8

5.3. Appendix 3: Financial and human resources

Parties	Forest inventory unit	Agriculture unit	GHG inventory unit
Argentina			NA
Bangladesh			
Botswana			
Burundi	NA	NA	NA
Cambodia			
Central Africa			
Chad			
Colombia			
Costa Rica	NA		
Ecuador			
Equatorial Guinea		Unclear	
Gabon			X
Ghana			
Guatemala			
Guyana			
Indonesia	X	X	X
Kenya			
Liberia			
Malawi			
Mexico			X
Namibia	X	X	X
Nepal	X		
Nigeria	X		X
Philippines	NA	NA	NA
Papua New Guinea	X	X	
Republic of Congo			
Rwanda			
Sao Tome and Principe			
South Africa		X	X
Sri Lanka			
Sudan	NA	NA	NA
Suriname	X		
Thailand			
Vietnam			
Zambia	NA	NA	NA
Total	6	4	6
NA	5	5	5

TABLE VI
DATA PRESENTED IN FIGURE 19: FINANCIAL RESOURCES AVAILABLE FOR THE NATIONAL GHG INVENTORY, BASED ON THE ANSWERS TO THE QUESTION "DO THE UNITS HAVE BUDGET DEDICATED FOR THE GHG INVENTORY DEVELOPMENT?"

Parties	National expert	Training plan
Argentina	NA	NA
Bangladesh	X	unclear
Botswana	X	
Burundi		NA
Cambodia		X
Central Africa		X
Chad	X	X
Colombia		X
Costa Rica		
Ecuador		unclear
Equatorial Guinea		X
Gabon	X	X
Ghana	X	
Guatemala		X
Guyana		X
Indonesia	X	NA
Kenya		X
Liberia		X
Malawi	X	X
Mexico	NA	
Namibia	X	X
Nepal		X
Nigeria		X
Philippines	X	X
Papua New Guinea	X	X
Republic of Congo	NA	unclear
Rwanda		
Sao Tome and Principe	X	NA
South Africa	X	X
Sri Lanka		NA
Sudan	X	NA
Suriname		X
Thailand		X
Vietnam		X
Zambia		X
Total	13	21
NA	3	6

TABLE VII

DATA PRESENTED IN FIGURE 20: HUMAN RESOURCES AVAILABLE FOR THE NATIONAL GHG INVENTORY, BASED ON THE ANSWERS TO THE QUESTION "ARE THE NATIONAL EXPERTS WITHIN THE NATIONAL

5.4. Appendix 4: Software development

TABLE VIII
DATA PRESENTED IN FIGURE 21: DEVELOPMENT OF SOFTWARE FOR THE NATIONAL GHG INVENTORY

Parties	New software developed	No new software developed	NA	UNFCCC software	Excel	Others
Argentina		X			X	
Bangladesh		X				LEAP model
Botswana		X		X		
Burundi		X		X		
Cambodia		X		X		
Central Africa		X			X	
Chad		X		X	X	
Colombia		X		X	X	
Costa Rica		X		X	X	
Ecuador		X			X	
Equatorial Guinea		X		X		
Gabon		X		X		
Ghana		X		X		
Guatemala		X		X		
Guyana		X		X		
Indonesia		X			X	
Kenya		X				
Liberia		X		X	X	
Malawi		X		X		
Mexico			X			
Namibia		X			X	
Nepal		X				
Nigeria		X		X		
Philippines			X	X		US EPA Template
Papua New Guinea		X		X	X	ALU software
Republic of Congo		X		X		
Rwanda		X		X		
Sao Tome and Principe		X		X		
South Africa	X			X		
Sri Lanka		X		X	X	
Sudan		X		X		
Suriname		X			X	
Thailand		X		X		SQL script and VBL code
Vietnam		X		X	X	
Zambia		X		X	X	
Total	1	32	2	24	15	4

5.5. Appendix 5: Archiving system

Parties	Have an archiving system	No archiving system	NA
Argentina	X		
Bangladesh	X		
Botswana	X		
Burundi	X		
Cambodia	X		
Central Africa		X	
Chad	X		
Colombia	X		
Costa Rica	X		
Ecuador	X		
Equatorial Guinea		X	
Gabon	X		
Ghana	X		
Guatemala	X		
Guyana	X		
Indonesia	X		
Kenya		X	
Liberia		X	
Malawi	X		
Mexico			X
Namibia		X	
Nepal		X	
Nigeria		X	
Philippines		X	
Papua New Guinea		X	
Republic of Congo	X		
Rwanda		X	
Sao Tome and Principe		X	
South Africa	X		
Sri Lanka		X	
Sudan	X		
Suriname		X	
Thailand	X		
Vietnam	X		
Zambia		X	
Total	20	14	1

TABLE IX
DATA PRESENTED IN FIGURE 22: PRESENCE OF ARCHIVING SYSTEM FOR THE NATIONAL GHG INVENTORY

Parties	Both	Only hard copy	Only electronic copy
Argentina	X		
Bangladesh		X	
Botswana		X	
Burundi	X		
Cambodia			X
Central Africa			
Chad	X		
Colombia	X		
Costa Rica	X		
Ecuador	X		
Equatorial Guinea			
Gabon	X		
Ghana	X		
Guatemala	X		
Guyana	X		
Indonesia		X	
Kenya			
Liberia			
Malawi	X		
Mexico			
Namibia			
Nepal			
Nigeria			
Philippines			
Papua New Guinea			
Republic of Congo	X		
Rwanda			
Sao Tome and Principe			
South Africa			X
Sri Lanka			
Sudan		X	
Suriname			
Thailand	X		
Vietnam	X		
Zambia			
Total	14	4	2

TABLE X
Data presented in Figure 23: Format of archiving system for the national GHG inventory

5.6. Appendix 6: Publication

Parties	National website with inventory information	Possibility to create one
Argentina	X	
Bangladesh		X
Botswana		
Burundi		X
Cambodia	X	
Central Africa		X
Chad		X
Colombia	X	
Costa Rica	X	
Ecuador		X
Equatorial Guinea		X
Gabon		
Ghana		X
Guatemala	X	
Guyana		X
Indonesia		X
Kenya		X
Liberia		X
Malawi		X
Mexico	NA	NA
Namibia		X
Nepal		X
Nigeria		X
Philippines		X
Papua New Guinea		X
Republic of Congo		X
Rwanda		X
Sao Tome and Principe		X
South Africa		X
Sri Lanka		X
Sudan		
Suriname		X
Thailand		X
Vietnam		X
Zambia		X
Total	5	26
NA	1	1

TABLE XI
DATA PRESENTED IN FIGURE 24: WEBSITE PUBLICATION, BASED ON THE ANSWERS TO THE QUESTIONS " DOES YOUR COUNTRY HAVE A NATIONAL GHG WEBSITE WITH INVENTORY INFORMATION AVAILABLE ON IT?" AND "IF NOT, WOULD IT BE POSSIBLE TO CREATE ONE?"

TABLE XII
DATA PRESENTED IN FIGURE 25: DIFFICULTIES REGARDING CREATING A NATIONAL GHG WEBSITE

Parties	Financial capacity	Technical capacity	Institutional capacity	Data	Others
Argentina					
Bangladesh			X		
Botswana	X				
Burundi		X			
Cambodia					
Central Africa	X				
Chad	X				
Colombia					
Costa Rica					
Ecuador					
Equatorial Guinea					Language differences
Gabon	X				
Ghana	X	X			
Guatemala					
Guyana		X			
Indonesia	X			X	
Kenya	X				
Liberia		X			
Malawi		X		X	
Mexico					
Namibia					
Nepal		X	X		
Nigeria			X	X	
Philippines			X		
Papua New Guinea			X		
Republic of Congo	X				
Rwanda	X	X			
Sao Tome and Principe		X			
South Africa				X	
Sri Lanka					
Sudan	X	X			
Suriname	X	X	X		
Thailand			X		
Vietnam	X	X			
Zambia		X	X		
Total	13	12	8	4	1

5.7. Appendix 7: Inventory cycle

TABLE XIII
DATA PRESENTED IN FIGURE 26: DEVELOPMENT CYCLE FOR GHG INVENTORY

Parties	Not yet defined	TCan be defined	No answer	Length of the cycle
Argentina	X			
Bangladesh		X		
Botswana	X			
Burundi			X	
Cambodia		X		2 years
Central Africa		X		8 months
Chad			X	
Colombia		X		8 months
Costa Rica		X		1 year and 8 months
Ecuador		X		8.5 months
Equatorial Guinea			X	
Gabon			X	
Ghana			X	
Guatemala		X		
Guyana			X	
Indonesia		X		
Kenya		X		11 months
Liberia			X	
Malawi			X	
Mexico		X		10 months
Namibia			X	
Nepal			X	
Nigeria			X	
Philippines			X	
Papua New Guinea			X	
Republic of Congo			X	
Rwanda		X		3 years
Sao Tome and Principe			X	
South Africa		X		1 year
Sri Lanka	X			
Sudan			X	
Suriname			X	
Thailand		X		3-4 years
Vietnam		X		
Zambia			X	
Total	3	14	18	

5.8. Appendix 8: Key category analysis

TABLE XIV
DATA PRESENTED IN FIGURE 27: KEY CATEGORY ANALYSIS PERFORMANCE

Parties	Performed	Not performed	No answer	Qualitative and Quantiative	Quantitative
Argentina	X				Tier 1
Bangladesh			X		
Botswana		X			
Burundi			X		
Cambodia	X				Tier 1
Central Africa		X			
Chad			X		
Colombia	X				Tier 1
Costa Rica	X				Tier 1
Ecuador			X		
Equatorial Guinea		X			
Gabon	X			X	
Ghana	X				Tier 1
Guatemala	X				Tier 1
Guyana	X				X
Indonesia			X		
Kenya	X			X	
Liberia	X			X	
Malawi		X			
Mexico			X		
Namibia		X			
Nepal		X			
Nigeria			X		
Philippines	X			X	
Papua New Guinea		X			
Republic of Congo			X		
Rwanda	X			X	
Sao Tome and Principe	X			X	
South Africa	X				X
Sri Lanka		X			
Sudan		X			
Suriname		X			
Thailand	X				Tier 1
Vietnam	X			X	
Zambia		X			
Total	16	11	8	7	9

5.9. Appendix 9: Current problems

TABLE XV
DATA PRESENTED IN FIGURE 28: CURRENT PROBLEMS IN FOREST CARBON STOCK

Parties	Data	Emission factor	Technical capacity	Cooperation	Others	No answer
Argentina	X					
Bangladesh						X
Botswana	X					
Burundi						X
Cambodia	X				Lacking forest MRV system	
Central Africa	X					
Chad						X
Colombia						X
Costa Rica	X					
Ecuador						X
Equatorial Guinea						X
Gabon	X	X				
Ghana	X					
Guatemala						X
Guyana						X
Indonesia						X
Kenya						X
Liberia						X
Malawi						X
Mexico	X					
Namibia						X
Nepal	X					
Nigeria	X					
Philippines						X
Papua New Guinea						X
Republic of Congo			X			
Rwanda						X
Sao Tome and Principe	X					
South Africa	X					
Sri Lanka	X			X		
Sudan						X
Suriname	X		X		Need institutions for forest assessment	
Thailand	X					
Vietnam	X		X		Lacking biomass expansion factor	
Zambia		X				
Total	17	2	3	1	3	17

TABLE XVI
DATA PRESENTED IN FIGURE 28: CURRENT PROBLEMS IN LAND REPRESENTATION

Parties	Data	Emission factor	Technical capacity	Cooperation	Others	No answer
Argentina	X					
Bangladesh						X
Botswana	X					
Burundi		X				
Cambodia	X					
Central Africa	X				Absence of related laws	
Chad						X
Colombia			X			
Costa Rica	X					
Ecuador						X
Equatorial Guinea						X
Gabon		X	X	X		
Ghana	X			X		
Guatemala	X					
Guyana						X
Indonesia						X
Kenya						X
Liberia						X
Malawi	X					
Mexico	X					
Namibia						X
Nepal	X					
Nigeria	X			X		
Philippines						X
Papua New Guinea						X
Republic of Congo	X		X			
Rwanda	X	X	X	X		
Sao Tome and Principe					IPCC denominations do not match national characteristics	
South Africa	X				Overlapping definition of forestlands and some biomes are not covered by the IPCC guidelines	
Sri Lanka	X	X		X		
Sudan						X
Suriname	X			X	Lacking financial resources	
Thailand	X					
Vietnam	X				Different definition of forest from the IPCC	
Zambia						X
Total	18	4	4	6	5	13

TABLE XVII
DATA PRESENTED IN FIGURE 28: CURRENT PROBLEMS IN FOREST CARBON STOCK

Parties	Data	Emission factor	Technical capacity	Cooperation	Others	No answer
Argentina	X					
Bangladesh						X
Botswana	X					
Burundi						X
Cambodia	X					
Central Africa	X					
Chad						X
Colombia					Need sustainable management of wetlands	
Costa Rica						X
Ecuador						X
Equatorial Guinea						X
Gabon	X	X	X	X		
Ghana						X
Guatemala						X
Guyana						X
Indonesia						X
Kenya						X
Liberia						X
Malawi					Problems with bush fires	
Mexico						X
Namibia						X
Nepal					Problems with private lands	
Nigeria	X					
Philippines						X
Papua New Guinea						X
Republic of Congo	X					
Rwanda						X
Sao Tome and Principe	X		X			
South Africa	X					
Sri Lanka	X			X		
Sudan						X
Suriname	X			X	Lacking financial resources	
Thailand	X					
Vietnam					Emission from forest fires are not estimated	
Zambia						X
Total	12	1	2	3	5	19

TABLE XVIII
DATA PRESENTED IN FIGURE 28: CURRENT PROBLEMS IN FOREST FIRE

Parties	Data	Emission factor	Technical capacity	Cooperation	Others	No answer
Argentina			Need support on remote sensing			
Bangladesh						X
Botswana	Lacking activity data					
Burundi		X				X
Cambodia	No data					
Central Africa	Lacking control and hence data on slash-and-burn farming					
Chad						X
Colombia	Lacking related data					
Costa Rica					No problem	
Ecuador						X
Equatorial Guinea						X
Gabon		X				
Ghana	Lacking updated data					
Guatemala						X
Guyana						X
Indonesia						X
Kenya						X
Liberia						X
Malawi						X
Mexico						X
Namibia						X
Nepal	Lacking crown fire and ground fire data					
Nigeria	No recored of forest fire inventory					
Philippines						X
Papua New Guinea						X
Republic of Congo	Lacking forest fire data					
Rwanda						X
Sao Tome and Principe	Lacking national data on forest fire					
South Africa	Need to harmonise data from various sources					
Sri Lanka	X			X		
Sudan						X
Suriname	X			X	Lacking financial resources	
Thailand	Lacking data for forest fire of private sector					
Vietnam						X
Zambia					No assessment to determine contribution of GHG emissions	
Total	13	2	1	2	3	19

TABLE XIX
DATA PRESENTED IN FIGURE 29: CURRENT PROBLEMS IN OTHER SECTORS, BASED ON THE ANSWERS TO THE QUESTION "PLEASE LIST DOWN MAJOR PROBLEMS, ISSUES AND CONCERNS IN THE AREA OF OTHER SECTORS"

Parties	Data	Emission factor	Technical capacity	Financial capacity	Cooperation	Others	No answer
Argentina	X				X		
Bangladesh							X
Botswana	X						
Burundi							X
Cambodia	X			X	X		
Central Africa					X		
Chad							X
Colombia						Need to analyse GHG emissions of reservoir water discharge	
Costa Rica	X	X					
Ecuador							X
Equatorial Guinea							X
Gabon	X	X	X	X	X	Need archiving system	
Ghana							X
Guatemala	X						
Guyana	X						
Indonesia							X
Kenya							X
Liberia							X
Malawi							X
Mexico							X
Namibia							X
Nepal							X
Nigeria					X		
Philippines							X
Papua New Guinea							X
Republic of Congo			X		X		
Rwanda							X
Sao Tome and Principe	X						
South Africa	X				X		
Sri Lanka	X	X			X		
Sudan							X
Suriname	X			X	X		
Thailand							
Vietnam		X					
Zambia							
Total	10	4	2	3	9	2	17

5.10. Appendix 10: Summary of the Latin American regional meeting

A Latin American regional meeting was held on the last day of the workshop. Participating countries were Mexico, Colombia, Costa Rica, Paraguay, Guatemala and Equatorial Guinea. Main goals were:

1) To identify National problems and possibilities of improvement along 5 areas to establish a national system for GHG Inventory: Institutional arrangements, Source-by-source documentation, QA/QC control, Key categories, and Improvement plan. The following table summarises a few aspects (box 1).

2) To identify Regional concerns and possibilities of cooperation to improve nationally identified concerns in the region (box 2).

3) To identify general concerns about the development of GHG inventories and the REDD+ mechanism (box 3)

Issues	**Current concerns**
Institutional arrangements	Short term consultants to do the Inventories Conflict of interests among agencies preventing clearly defined competences Lack of capacity Lack of political priority for GHG Inventories
Source-by-source documentation	Lack of inclusion of original datasets in the documentation Lack of replicability of the data
QA/QC control	QA/QC at the end of the collection of datasets and data analysis there is a lack of quality standards IPCC QA/QC protocols unknown or difficult to understand
Key categories	KCA defined without much consideration of evolution of National Communications
Improvement plan	GHG Inventories are not necessarily a national priority

Box 1: Brief summary of some aspects identified as problematic in the National GHG System

Box 2: Some aspects of regional importance to improve national GHG systems.

- Need to develop a regional approach to develop Emission Factors for similar biogeographical regions: Andean Montane forest EF, Paramo EF, Andean Dry forest EF, Amazonian forest EF, etc. Search for an appropriate institution to delegate this competence and search for funding opportunities.
- Need to develop regional centers and delegate competences to support the monitoring and early warning of forest disturbances (i.e. Fire already available through INPE Queimadas Service)
- Need to develop regional centers and delegate competences to monitor changes in land use and land cover (activity data) with consistent methodologies (i.e. INPE could be in charge of developing AD for the Amazonian Basin).
- Considerations of funding and national sovereignty regarding the data produced by a third party for another country.
- Possibility to hold regional training workshops to move from 1996 to 2003 and 2006 IPCC guidelines (i.e. EPA workshops and software training)
- Lack of coordination among donors -and countries- on similarly funded projects related to forest mitigation activities and/or forest adaptation activities (i.e. RPP, NJP, GIZ, USAID, GEF, etc): need to develop national/regional archives that are available through the website, with updated and transparent information on all currently active projects on REDD+, forest monitoring, KP flexible mechanisms, etc.

Box 3: Some general comments on aspects related to National GHG systems.

- Need to incorporate the debate of the GHG Inventory systems in a larger national context where adaptation is nationally a much higher priority than mitigation (i.e. food security, response to natural emergencies: currently this year, many Latin American countries are suffering from severe La Niï¿a floods and droughts). Some countries are already advancing in this more integrated approach.
- Need to incorporate the discussion of GHG Inventories in a broader context where not only carbon is considered but also the other International Conventions: Biodiversity and Desertification.
- Monitoring efforts for GHG Inventories should be used for a broader set of national interests that should incorporate other ecosystems services (i.e water and biodiversity) but also could include the development of a better network of meteorological stations to improve internal knowledge on national climate and climate changes.