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National Inventory System for Greenhouse Gas Inventory in the context of REDD+ activities

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Paper prepared for the Training Workshop on National Systems for GHG Inventories Building capacity on setting national systems for greenhouse gas inventories, reporting emissions and removals from REDD+ activities in the framework of the UN-REDD programme, Rome 24-28 January 2011.

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FOREWORD

The UN-REDD Programme is the United Nations Collaborative initiative on Reducing Emissions from Deforestation and forest Degradation in developing countries. The Programme was launched in September 2008 to assist developing countries in preparing and implementing national REDD+ strategies, and builds on the convening power and expertise of the Food and Agriculture Organization of the United Nations (FAO), the United Nations Development Programme (UNDP) and the United Nations Environment Programme (UNEP).

Emission reductions through REDD+ will have to be reported to the UNFCCC. The core elements of the country communication to the UNFCCC are information on emissions and removals of greenhouse gases (GHGs) and details of the activities a party has undertaken. Assessment of the GHG inventory for Annex I parties under the Kyoto Protocol began in 2006 and is performed annually. In order to ensure the continuity of the reporting processes, article 5, paragraph 1, of the Kyoto Protocol provides guidelines for the planning, preparation and management of the national system. This includes institutional, legal and procedural arrangements made by a Party for estimating emissions by sources and removals by sinks of anthropogenic GHGs not controlled by the Montreal Protocol. When considering non-Annex I parties, national communications to the UNFCCC can provide information on the national system but this is not mandatory. Since the data obtained to establish a forest GHG inventory in the context of REDD+ will likely be obtained from different actors (institutions, organizations and stakeholders), the development of country-specific national systems is crucial.

Experiences from Annex I countries can be gathered in order to provide lessons and advice for this process. This paper was prepared for the Training Workshop on National Systems for GHG Inventories - Building capacity on setting national systems for greenhouse gas inventories, reporting emissions and removals from REDD+ activities in the framework of the UN-REDD Programme. The main objective of the workshop was to provide information and training on setting national systems for GHG inventories.

LIST OF ACRONYMS

AK	The Institute of Agricultural Climate Research
ATKIS	The Official Topographic-Cartographic Information System
BMELV	Ministry of Food, Agriculture and Consumer Protection
CBERS	China-Brazil Earth Resources Satellite Program
CRF	Common Reporting Format
CSIRO	Commonwealth Scientific and Industrial Research Organization
DCCEE	Department of Climate Change and Energy Efficiency of Australia
EF	Emission Factor
EPA	Environmental Protection Agency
ERT	Expert Review Team
EU	European Union
ExEA	Executive Environmental Agency
FAO	The Food and Agriculture Organization of the United Nations
FOEN	Swiss Federal Office for the Environment
FullCAM	Full Carbon Accounting Model
GEF	Global Environment Facility
GHG	Greenhouse Gas
GIS	Geographic Information System
GOFC-GOLD	Global Observation of Forest and Land Cover Dynamics
GPG	Good Practice Guidance
IPCC	Intergovernmental Panel on Climate Change
IRCEL-CELINE	Interregional Cell for the Environment
ISO	International Standards for Business, Government and Society
LULUCF	Land Use, Land use Change and Forestry
MOU	Memorandum of understanding
MRV	Measuring, Reporting and Verifying
NA	Not Available
NCAS	National Carbon Accounting System of Australia
NERI	National Environmental Research Institute
NS	Not clearly specified
NFI	National Forest Inventory
NIR	GHG National Inventory Report
QA	Quality Assurance
QC	Quality Control
REDD	Reducing Emissions from Deforestation and Degradation
SNE	Single National Entity
SPOT	Satellite Pour l'Observation de la Terre (France)
UBA	Federal Environment Agency
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
vTI	Johann Heinrich von Thunen Institute

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EXECUTIVE SUMMARY

Based on the current status of negotiations under the UNFCCC, REDD+ will be included in a mechanism that mobilises financial resources to developing countries for climate change mitigation activities. To achieve this goal, the REDD+ mechanism requires a common approach to measuring, reporting and verifying (MRV) results to ensure the transparency, the completeness, the consistency, the accuracy and the comparability across Parties. A robust national GHG inventory can provide basic capacity that all Parties need in order to eventually adopt the MRV approach. At present, REDD+ covers the forestry sector in non-Annex I Parties. Hence, the land-use, land-use change and forestry (LULUCF) sector of the inventory – an integral part of the emissions and removals of forestry – deserves high attention.

The development of the GHG inventory, including the LULUCF sector in non-Annex I Parties however are facing a number of constraints with regards to legal, institutional and procedural arrangements. To a great extent, this is due to limited experiences in developing inventories. The Parties have benefited from the cumulative experiences especially in developing the inventory annually as well as through facilitative reviews. Consequently, they are generally more established in their legal, institutional and procedural arrangements of the national GHG inventory, including the LULUCF sector. Parties still encounter difficulties in developing inventories, yet these are to a lesser extent than those of the non-Annex I Parties.

The goal of this report is to identify and overcome the difficulties in developing the GHG inventory of the LULUCF sector in non-Annex I Parties. Based on the analysis of Annex I Parties, meaningful recommendations are provided for the non-Annex I Parties as means to significantly overcome difficulties. The following data sources are analysed to fulfil the goal: official national reports to the UNFCCC, research reports and publications and 11 complete questionnaires on national systems for GHG inventory that were compiled for the workshop. Furthermore, a set of indicators has been derived to help assess the development of the LULUCF inventory. The indicators were identified as legal, institutional and procedural arrangements.

According to the analysis of the reports from Annex I Parties, legal arrangements are present. Some were built on existing legislation. Over half of the Parties have national legislation relating to planning, preparation and management of the national GHG inventory, with three Parties using memorandum of understandings (MOUs) to specifically address the LULUCF sector. Supportive legal instruments for data collection and other procedures are adopted by almost half of the parties. Institutional arrangements are generally structured with clearly identified responsibilities. Six Parties integrated their arrangements with their existing framework. Almost all parties identify the lead agency of the national GHG inventory and nearly half identify the lead agency of the GHG inventory development of the LULUCF sector. Apart from the use of legal instruments, nearly half of the Parties establish governance mechanisms to enhance the institutional relationship further. Most Parties have procedural arrangements to quality-check outputs. Over half of the Parties employ Tier 1 level for key category analysis and quality control (QC) activities and adopt the 3rd Party review as part of quality assurance (QA) procedures. Most Parties use a combination of Tier 1, 2 and 3 methodologies, and default or country-specific emission factors (EFs) for estimating emissions and removals. Archiving is performed in almost 75% of Parties. The use of higher tiers for key category analysis, calculation and QC, and the adoption of country-specific EFs, public review, international quality standard and LULUCF inventory management software are present in a number of Parties. Evidence shows that most Annex I Parties are committed to improve the legal, institutional and procedural arrangements of the GHG inventory of the LULUCF sector. Despite the progress, Parties still encounter certain difficulties: insufficient national capacity, inaccessible data and financial constraints.

According to the analysis of non-Annex I Parties, establishment and implementation of legal arrangements remain limited. Six Parties report the existence of legal instruments to mandate the GHG inventory development of the LULUCF sector. About one third of Parties establish an entity charged with the development of a national forest inventory (NFI), which represents one of the key data sources for the estimation, with international support. Eight Parties indicate the lack of such arrangements. No other supportive legal instruments are reported. Institutional arrangements and relationships between the involved entities remain restricted. Almost half of the non-Annex I Parties

identify the lead agency of the national GHG inventory and over 25% identify the lead agency of the LULUCF sector. Seven Parties reveal that the arrangement for the inventory system of the LULUCF sector remains on an ad-hoc basis. QA/QC activities are not reported. Two Parties reveal the use of Tier 1 methodology and the use of country-specific EFs. No parties report the use of public review, international quality standard and specific software for the LULUCF. The strong commitment to the improvement of inventories for the LULUCF sector seen in Annex I Parties over the past decade is lacking in many non-Annex I Parties. Major barriers can be identified as the following: inadequate legislative frameworks, institutional instability, weak coordination, insufficient technical capacity, lack of data availability and financial constraints.

In response to these shortcomings, the proposed general recommendations are: i) improvement of legislative frameworks, ii) bolstering of institutional stability, iii) strengthening of institutional coordination, iv) enhancement of technical capacity, v) securing data availability and vi) undertaking of financial planning.

1 INTRODUCTION

Continuing efforts to formulate REDD+ programmes have been observable. The methodological guidance of REDD+ (Reducing emissions from deforestation and forest degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries) was adopted in Copenhagen following the process made in the 13th Conference of the Parties (COP) at Bali in 2007. Similarly, during the COP 16th at Cancun in 2010, a Decision on the policy approaches and incentives on issues relating to REDD+ was made.

While there is high interest in seeing such initiatives take form, more work remains to be done to ensure that national-level REDD+ programmes are successfully established and implemented. Specifically, a key challenge for developing countries wishing to take part in the expected REDD+ mechanism will be to design operational, national forest monitoring systems to support the MRV requirements of the Decision of the UNFCCC.

In this light, the national GHG inventory serves as the foundation – a basic capacity that all Parties need – to move towards the MRV approach. At present REDD+ is defined as covering only the forestry sector (2). The LULUCF sector of the inventory of non-Annex I Parties therefore deserves high attention, since the activities represent an integral role of GHG emissions and removals from forestry (3).

In non-Annex I Parties (developing countries), requirements for the reporting of information under Article 12 of the Convention have resulted in less frequent reporting than in Annex I Parties (developed countries) (1). The vast majority of non Annex I Parties submitted only one national communication. Of the 153 non-Annex I Parties, 137 have submitted their initial communications, 24 their second national communications and one Party each for their third and fourth national communications (4). There is no requirement for a national inventory system and thus the arrangements for the national GHG inventory, including the LULUCF inventory system, are the key element of each national communication cycle (1). Almost one third of Parties have national GHG inventories which are less than 50% complete (5). This implies that non-Annex I Parties

have had problems, gaps and constraints in the development of their national GHG inventories, including the LULUCF sector.

Annex I Parties are also faced with difficulties in developing the GHG inventory, but to a lesser extent. Parties have by and large benefitted from the cumulative experiences of developing national GHG inventories, including for the LULUCF sector. Annual GHG inventories of Annex I Parties have been a requirement since the decision was adopted in 1998 (1). Regular reporting is complemented with in-depth review process, facilitating continuous improvement. The goal of this report is to help identify and overcome the challenges for the development of a GHG inventory for the LULUCF sector in non-Annex I Parties. In order to achieve the goal, the current practices for planning, preparation and management of the GHG inventory of the LULUCF sector in non-Annex I Parties as well as Annex I Parties will be assessed. Subsequently, based on the analysis of Annex I Parties, generic recommendations are proposed for the non-Annex I Parties as means to overcome the identified difficulties in developing GHG inventories for the LULUCF sector.

Chapter 2 describes the methodological issues covering the identification of indicators, data sources and limitations. Chapter 3 presents the analysis of current practices in preparing the GHG inventory for the LULUCF sector of Annex I Parties based on the set of indicators and parameters laid out in Chapter 2. Chapter 4 provides the analysis for non-Annex I Parties with a similar set of indicators and parameters. Chapter 5 concludes the report by identifying current challenges and providing recommendations to overcome these in preparing a GHG inventory for the LULUCF sector in non-Annex I Parties.

2 METHODOLOGY

This chapter set out the scope for the selection of indicators and associated parameters, as well as the sources of data and data limitations for the analysis of this report.

2.1 Scope

This report aims to analyse the current capabilities and challenges facing non-Annex I Parties in establishing a GHG forest inventory in the context of REDD+¹. The LULUCF activities represent a significant part of the GHG emissions and removals from the forest (3). This report therefore focuses its analysis on the LULUCF sector of the national GHG inventory in order to provide meaningful recommendations for the establishment of a national system for REDD+.

The report addresses all Annex I Parties with the exception of Belarus, Ukraine and Russia due to language barriers. It covers 38 Annex I Parties in total. The report covers 32 non-Annex I Parties, including Parties participating in the UN-REDD Programme² and Parties that completed the questionnaires for the workshop³ on national systems for GHG inventory held in FAO headquarter from 24 to 28 January 2011.

2.2 Identification of indicators

To fulfil the goal of the report, indicators have been developed to help assess obstacles to preparing GHG inventories for the LULUCF sector in non-Annex I Parties and identify means to overcome these obstacles from practices and arrangements in Annex I Parties. The indicators are legal, institutional and procedural arrangements.

Under Article 5 paragraph 1 of the Kyoto Protocol (6), a national system encompasses the institutional, legal and procedural arrangements made within a Party for estimating anthropogenic emissions by sources and removals by sinks of all GHGs not controlled by the Montreal Protocol. These building blocks contain priority activities

¹ Activities relating to reducing emissions from deforestation and forest degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries

² This includes UN-REDD pilot countries and other participating countries to the UN-REDD.

³ Bangladesh, Botswana, Burundi, Costa Rica, Equatorial Guinea, Gabon, Malawi, Nepal, South Africa, Sri Lanka, Sudan

which form the basis of inventory reports. While these elements overlap, we found them to provide a useful analytical framework for analysing and guiding choices in the design of inventory systems. They were therefore selected as the indicators for the purpose of this analysis (Figure 1).

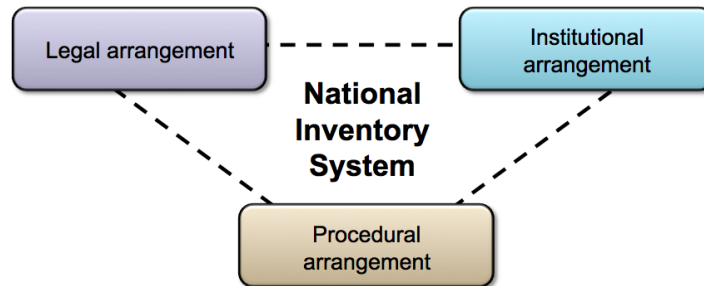


Figure 1: Indicators of GHG inventory for the LULUCF sector

Legal arrangements describe a collection of laws and legal commitments for the implementation of the GHG inventory for the LULUCF sector. Such legal instruments are developed to legitimize and institutionalize the various tasks involved during the development of the GHG inventory for the LULUCF sector. These consist of legal instruments, which regulate the development of the LULUCF sector GHG inventory, data acquisition, and facilitation of inventory development (Figure 2).

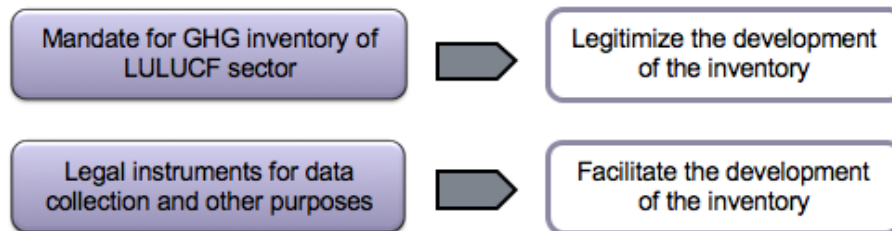


Figure 2: Parameters of legal arrangement

Institutional arrangements describe the roles and responsibilities of actors involved in the development of the GHG inventory for the LULUCF sector. Such arrangements aim to facilitate the smooth operation and efficient use of limited resources. In the context of this report, institutional arrangements are defined by the existence of lead agency for the national GHG inventory and a different lead agency for the LULUCF sector for planning, preparation and management, as well as formally established institutional structures and relationships between the entities (Figure 3).

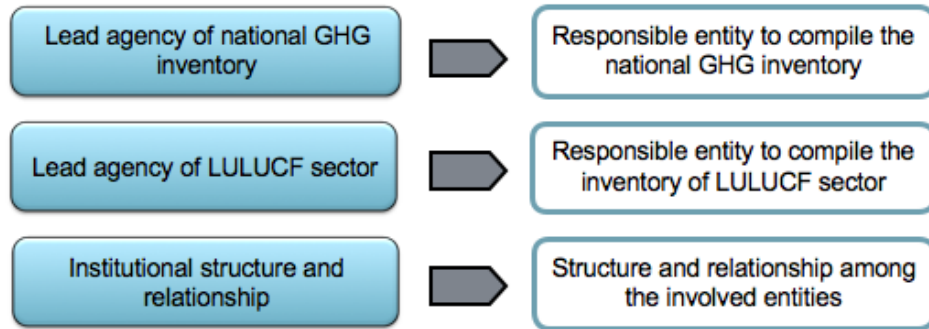


Figure 3: Parameters of institutional arrangement

Procedural arrangements describe the process and activities necessary for the implementation of the LULUCF inventory. Such arrangements aim to ensure precise and accurate outputs from the inventory. In the context of this report, procedural arrangements consist of key category analysis, quality management systems, estimation methodologies and inventory management, including archiving (Figure 4).

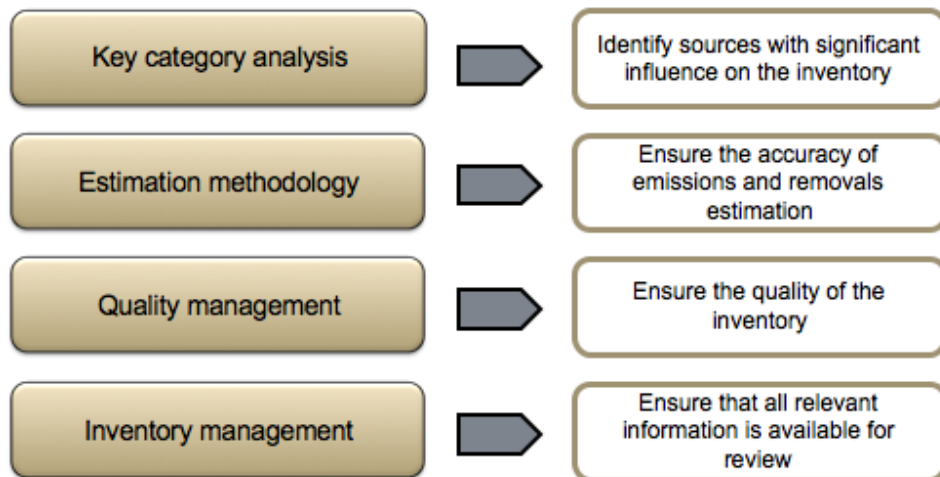


Figure 4: Parameters of procedural arrangement

2.3 Data sources

To ensure credibility and validity of data and analysis, all data used in the analysis presented in this report comes from official documents published on the UNFCCC website. For Annex I Parties, documents are in the form of National Inventory Reports (NIRs). For non-Annex I Parties, documents are in form of National Communications, research reports and publications and 11 completed questionnaires.

Table 1: List of data sources

Indicators	Data sources
Annex I Parties	
Legal arrangement	- National Inventory Report 2010 submissions
Institutional arrangement	- National Inventory Report 2010 submissions
Procedural arrangement	- National Inventory Report 2010 submissions
Non- Annex I Parties	
Legal arrangement	- National Communication (latest submissions) - Completed Questionnaires
Institutional arrangement	- National Communication (latest submissions) - Completed Questionnaire for the Workshop - GOF-C-GOLD publication (5)
Procedural arrangement	- National Communication (latest submissions) - Completed Questionnaire for the Workshop

The availability of national documents does not guarantee sufficient information about countries' GHG inventories, particularly relating to the LULUCF sector. The depth of this analysis is limited by information availability. In this light, the questionnaire, which is prepared for the workshop, and research reports and publications are also analyzed in an attempt to fill the information gap and facilitate better analysis of the non-Annex I Parties.

2.4 Limitations

Primary limitations of this report are: the lack of availability of national reports, language barriers and limited provision of information in the documents. As a result, the national communications of Zambia, Central African Republic and Equatorial Guinea are not analysed.

Zambia and Central African Republic's national communications are unavailable via the UNFCCC website despite it having been submitted. Equatorial Guinea's communication is not available since the Party has not submitted the document. All national reports in English and French are included in the analysis; documents in Spanish and Russian are not covered in this analysis. As a result, the national communications of Argentina, Panama, Costa Rica, Mexico, Belarus, Ukraine and Russia are not included. Nevertheless, the information presented in the available national reports, completed questionnaires and relevant publications is at times limited or not clearly specified.

3 NATIONAL SYSTEMS FOR GHG INVENTORY IN ANNEX I PARTIES

This section provides the analysis of the national system of the LULUCF sector in Annex I Parties. The analysis is divided into legal, institutional and procedural arrangements as identified in Chapter 2.

3.1 Legal arrangements

Legal arrangements consist of instruments to help prepare the GHG inventory for the LULUCF sector. Legislation regulating the development of the national inventory indirectly stipulates the establishment of a GHG inventory for the LULUCF sector. Legal instruments, which regulate the development of the inventory for the LULUCF sector, are also included. Such instruments as well as the ones facilitating data collection and other functions are discussed. Details of the arrangements of each Party are illustrated in Appendix 1.

3.1.1 Mandate for the GHG inventory for LULUCF sector

Under Article 5 Paragraph 1 of the Kyoto Protocol (6), a single national entity (SNE) with overall responsibility for planning, preparation and management of the national inventory should be identified. When backed by national legislation, the SNE becomes an authorized entity and, in effect, the development of the GHG inventory, including the LULUCF sector, becomes mandatory by law.

The majority of Annex I Parties (22 Parties) have national legislation to designate an entity with overall responsibility for the development of the GHG inventory. The remainder, despite the legislative backing, reported to have an entity assigned with these responsibilities. Among the Parties with appropriate legislation, Bulgaria has comparatively more extensive coverage than others, including its authority, responsibility of the entity as well as staff.

The possession of national legislation specifically for LULUCF institutionalization remains limited to one Party: Germany implemented State-secretary Resolution of 22 December 2006 to designate the Ministry of Food, Agriculture and

Consumer Protection (BMELV) as the agency responsible for preparing the country's LULUCF inventory. Germany also passed Directive of 29 August 2007 to authorise the lead agency to compile the GHG inventory for the LULUCF sector(7) .

Legal commitments, i.e. contract, MOU and formal agreement, are also used to assign an entity with responsibility for developing the GHG inventory for the LULUCF sector, with three Parties (Finland, Croatia and the UK).

3.1.2 Mandate for LULUCF data collection and other purposes

In the process of the GHG inventory development, efforts are primarily focused on data collection. Three Parties have implemented national legislations to provide authority for this data collection. The Czech Republic reports the use of existing laws⁴ providing an authority for the Office for Surveying, Mapping and Cadastre to collect data on land-use and land-use change (8). In Germany, fertilizer manufacturers are required to report on sales to Lander Statistical Offices which feed into surveys of soil use and condition, which are in turn data inputs for the LULUCF sector (7). In addition, Hungary implemented a new Act⁵ to give direct authorisation to the Ministry of Environment and Water to collect necessary data to develop the national inventory, including the LULUCF sector (10).

Over a quarter of the Annex I Parties in the analysis (10 Parties) report the use of legal commitments to support data collection – commonly in form of MOU, formal arrangements and contracts. The popularity of these legal commitments compared to the national legislations is likely to stem from their flexibility. For example, an MOU between the inventory agency and main data provider helps specify the framework for data supply, e.g. data quality, format, timeliness and security to underpin the GHG inventory. It nonetheless flexible and can be amended according to needs and detected failures and/or cancelled once the agreement period is over, and takes less time to establish. Along the same line, the UK intends to conclude more MOUs with key data providers (9).

Other supportive formal legal instruments also exist. For instance, the Finances Act of Hungary legitimises the budget needed for the national GHG inventory, including

⁴ Act No. 265/1992 Coll. and Act No. 344/1992 Coll. on the real estate cadastre

⁵ Act LX of 2007

the LULUCF sector (10). Similarly, the Austria's Environmental Control Act secures financial resources for the inventory agency in order to fulfil its responsibility of developing the national inventory, among other responsibilities (11).

As for the legal commitments, eight Parties adopt instruments for other purposes, e.g. securing services for the calculation of emissions and removals, QA/QC, uncertainty analysis and archiving. For example, in Estonia signed a formal agreement with the Estonian Environmental Research Centre and Tallinn University of Technology to transfer them the responsibility for QA/QC and archiving. The agreement is reviewed annually (12).

Table 2: Status of legal commitments for LULUCF preparation

	Lead agency	Data collection	Calculation	QA/QC	Others
Agreement	Finland	New Zealand Iceland Estonia	Germany	Estonia	Estonia
MOU		Sweden Ireland Canada Australia	Sweden Ireland		
Contract	Croatia UK	UK New Zealand Netherlands	UK Bulgaria	New Zealand Luxembourg	Luxembourg

Note: Others refer to uncertainty analysis and archiving
Parties that are not included in the table imply that either the relevant information is not available or it is not clearly specified.

Source: NIR 2010 submissions

The length of legal commitments varies among Parties, e.g. Estonia's 1-year contract for QA/QC and archiving activities (12) contrasts Sweden's 9-year contract with inventory compiler (13). Short-term commitment in LULUCF is, however, discouraged. According to the ERT review for Estonia, the short-term agreement with sectoral experts should be amended because it creates uncertainties and inhibits the benefits of capacity building gained from long-term commitment. Similar comments were made in order to promote long-term employment contracts in Slovakia's LULUCF sector (14).

3.2 Institutional arrangements

Institutional arrangements comprise structural frameworks for the development of GHG inventories for the LULUCF sector as well as the relationships among different agencies and organizations involved in the process. The arrangement of principal agencies – lead agencies for the development of the national GHG inventory and the LULUCF sector – and institutional structures as well as institutional relationships among involved entities are discussed. Details of the arrangement of each Party are illustrated in Appendix 2.

3.2.1 Lead agency of the national GHG inventory

All 38 Parties have assigned an entity with overall responsibility for preparing the national GHG inventory, which covers the LULUCF sector. Most Parties have appointed a lead agency for compiling the national inventory under the supervision of the reporting agency, which is an agency with responsibility for reporting the national GHG inventory to the UNFCCC Secretariat. 9 Parties have a lead agency, which also performs a reporting role for the national GHG inventory. Although the position of the lead agency for the LULUCF sector is often delegated to other entities with sectoral expertise, the lead agency for the national GHG inventory development has a direct supervisory role and responsibility to monitor the national GHG inventory for the LULUCF sector.

The role of the lead agency for the national GHG inventory position is generally assigned to a central government agency. Table 3 reveals that 29 Parties have government agency as the lead agency, while 6 and 2 Parties have research institute and consultancy firm as the lead agency, respectively.

The choice of the lead agency varies among parties. To many Parties, it is constrained by the existing framework for inventory development. To illustrate, six Parties⁶ reveal that they develop the institutional arrangements for the national GHG inventory through an integrated approach with the existing framework for air pollution, e.g. Long-range Transboundary Air Pollution Convention⁷.

⁶ Netherlands, Luxembourg, Poland, Portugal and Switzerland

⁷ <http://www.unece.org/env/lrtap/>

Table 3: Type of lead agency of national GHG inventory

Government agency			Research institute	University	Consultancy firm
Australia	Iceland	Portugal	Belarus	NA	Austria
Belgium	Ireland	Romania	Czech republic		UK
Bulgaria	Latvia	Spain	Croatia		
Canada	Liechtenstein	Sweden	Denmark		
Estonia	Lithuania	Switzerland	Italy		
EU	Luxembourg	Slovakia	Japan		
Finland	Netherlands	Slovenia			
Germany	New Zealand	Turkey			
Greece	Norway	USA			
Hungary	Poland				

Note: Parties that are not included in the table imply that either the relevant information is not available or it is not clearly specified.

Source: NIR 2010 submissions

3.2.2 Lead agency of the GHG inventory for the LULUCF sector

In most Parties, the lead agency of the GHG inventory development often allocates the technical development of the inventory for each sector to sectoral experts in research institutes, universities and consultancy firms. Almost half of Annex I Parties (18 Parties) identify the lead agency for the GHG inventory for the LULUCF sector and 13 of them report the allocation of work to different entities. Three Parties delegate the responsibility to a government agency, while seven Parties and three Parties delegate the responsibility to research institute and university, respectively. The lead agencies of national GHG inventories in five Parties on the other hand do not delegate the work; instead they also assume the role of lead agency for the LULUCF sector.

Table 4: Type of lead agency for the LULUCF sector

Government agency	Research institute	University	Consultancy firm
<i>Australia</i>	<i>Croatia</i>	Denmark	<i>Austria</i>
<i>Belgium</i>	Czech republic	Estonia	
<i>Bulgaria</i>	Finland	Iceland	
Canada	Germany		
Hungary	Ireland		
Switzerland	Latvia		
	Norway		
	Slovenia		

Note: Parties that are not included in the table imply that either the relevant information is not available or it is not clearly specified.

Source: NIR 2010 submissions

Similarly to the lead agency for the national GHG inventory, the existing framework of the Party can largely influence the choice of institutional arrangements for the LULUCF sector. For example, Norway's arrangement is based on existing cooperation for national inventory that has been produced over 20 years. The inventory preparation is delegated to 3 core agencies and the LULUCF sector is delegated to one of

the core agencies with specialization in forestry inventory (21). The integration of existing frameworks not only provides means to exploit and optimise available resources, but also to help minimise redundant and overlapping activities.

3.2.3 Institutional structures and relationships

Despite the differences in institutional arrangements, it can be generalised that the structure of the inventory system of the LULUCF sector comprises units for spatial data input development, modelling, estimation of GHG emissions and removals, QA/QC, uncertainty analyses, archiving and reporting. 2 Parties provide an illustration of the institutional structure of the LULUCF sector; they are Australia and Germany, shown in Box 1 and 2 respectively.

BOX 1: Australian institutional arrangement of the LULUCF sector

The development of National Carbon Accounting System (NCAS) began in 1998, specifically to estimate Australia's GHG emissions from land-based sectors. Australia currently invests about AUD \$ 4 million per year in NCAS. The NCAS is being progressively developed to provide a complete GHG accounting framework for LULUCF and agriculture. The development of the NCAS involved many external public and private sector entities. At the heart of the NCAS is the Full Carbon Accounting Model (FullCAM), which is a terrestrial ecosystem model that calculates GHG emissions and removals in both forest and agricultural land.

Responsibility for the development and use of the NCAS lies with the Land Management Branch within the Department of Climate Change and Energy Efficiency (DCCEE). The Land Management Branch consists of five units. (1) The geographic information system (GIS) and remote sensing unit coordinate the derivation of spatial data inputs for ecosystem models within FullCAM. (2) The FullCAM development unit develops and maintains documents and tests software to run the ecosystem models with FullCAM. (3) The forest inventory unit coordinates the GHG estimation and reporting from the LULUCF sector, using the FullCAM models, as well as archiving. (4) The agriculture unit uses FullCAM to provide figures for GHG emissions from agricultural activities. (5) The land sector unit provides policy advice to the government based on the GHG estimations. The NCAS team also coordinates QA, QC, calibration, validation and

verification activities associated with each of these elements. The NCAS staffs have qualifications and expertise commensurate with the activities.

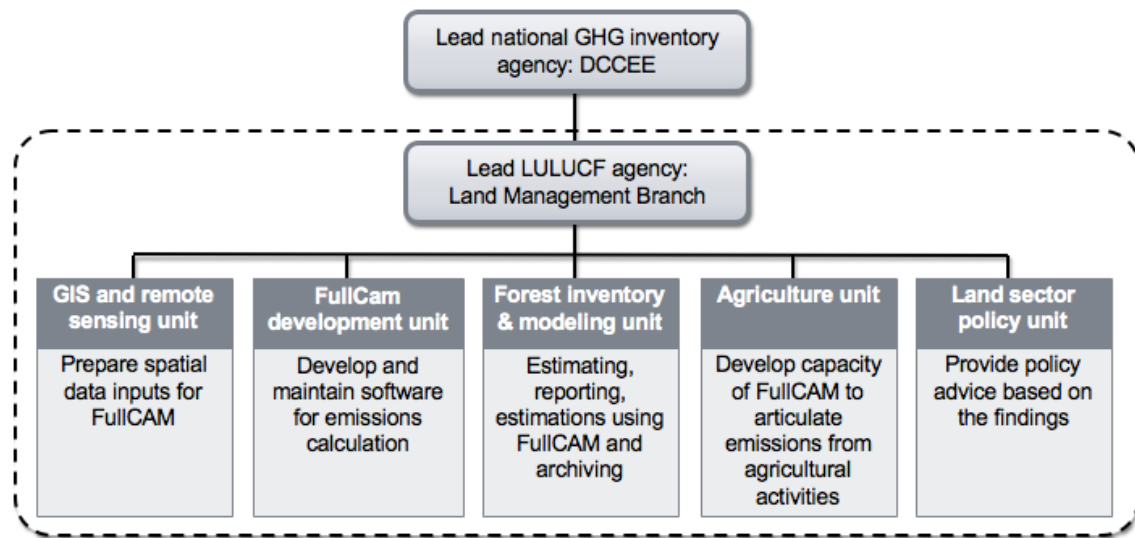


Figure 5: Australian institutional structure of LULUCF sector

Source: NIR 2010 submission of Australia (22)

BOX 2: German institutional arrangement of the LULUCF sector

The Federal Environment Agency (UBA) is the lead agency for the national GHG inventory development in Germany. It has central responsibility for inventories, planning, QC, management and archiving. In relation to the LULUCF sector, the responsible agency for the estimation of emissions and removals from the LULUCF sector is required to report the estimates to the UBA. The responsibility for estimating and archiving of emissions and removals from the agriculture and land-use and land-use change sectors lies with the the Johann Heinrich von Thunen Institute (vTI)'s Institute of Agricultural Climate Research (AK). Responsibility for estimating and archiving of emissions and removals from forest lies with the vTI's Institute of Forest Ecology and Forest Inventory.

Other institutions provide support. The Surveying Authorities of the Lander and the Federal Agency for Cartography and Geodesy develops and maintains the digital landscape model, called ATKIS. By using the model, they provide annual GIS and land-use data on an annual basis. The Federal Statistical Office prepares the main survey on

soil use. The vTI institute of World Forestry, of Forest Based Sector Economics and of Wood Technology and Wood Biology also provides inputs for the estimate.

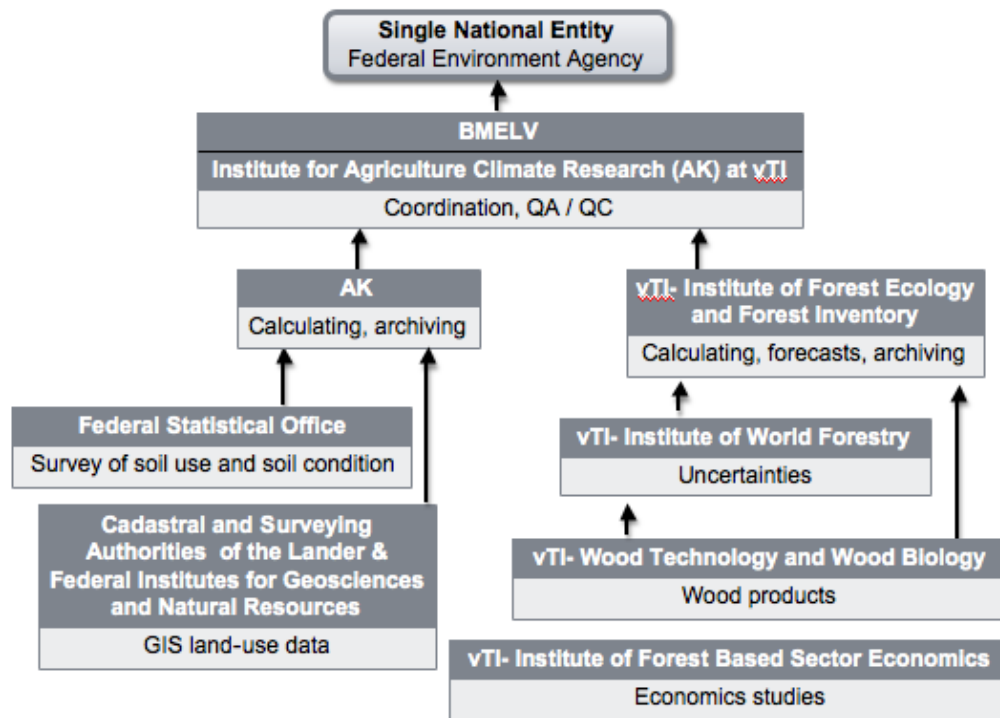


Figure 6: German institutional structure of LULUCF sector

Source: NIR 2010 submission of Germany (7)

As illustrated, the development of the GHG inventory of the LULUCF sector involves a large number of government agencies, institutions and organizations. Insufficient cooperation was and remains a concern in many Parties, e.g. Estonia, Slovakia and the UK. Consequently, myriad governance mechanisms have been implemented to ensure strong cooperation among the involved Parties. There are two approaches to the establishment governance mechanisms.

The first approach involves the use of legal instruments to secure coordination and cooperation among involved agencies, while the second approach does not. The first one helps strengthen the institution in many dimensions, particularly the relationships with key data providers, as discussed earlier. The second approach is less formal and generally comprises working groups, coordinating teams, advisory boards and steering

committees. Such mechanisms not only ensure timely delivery of the inventory, but also to provide an information exchange platform.

For example a working group called Monitoring, Accounting and Reporting System framework of Canada provides means for coordinating, planning and integrating the activities of many groups of scientists and experts across several government levels and research institutions in many sectors including agriculture and forestry (23). As another example, the European Union (EU) working group is established not only to drive the timely delivery and improvement of the inventory but also to provide a platform for the exchange of information and experiences in conducting the inventories among member states (14). Additional to Canada and the EU, 14 other Parties⁸ have the mechanisms covering LULUCF sector in place.

3.3 Procedural arrangements

Procedural arrangements consist of activities to develop the GHG inventory of the LULUCF sector. The practices of key category analysis, estimation methodologies, quality management and inventory management, including archiving, are discussed. Details of the arrangement of each Party are illustrated in Appendix 3.

3.3.1 Key category analysis

Key category analysis enhances accuracy by identifying categories with significant influence over the Party's total inventory. According to IPCC GPG, Tier 2 methodology should be employed where possible. According to IPCC Guidelines, it is good practice to include key categories from both Tier 1 and 2 (21).

All 38 Annex I Parties use key category analysis in all sectors including LULUCF. Over half of the Parties reveal the adoption of Tier 1 level for the analysis. Three Parties use Tier 2 level methodology and 10 Parties report the use of both Tier 1 and Tier 2 for the analysis (Table 5). The 2009 ERT reviews encouraged the use of Tier 2

⁸ Belgium, Estonia, Finland, Germany, Iceland, Italy, Japan, New Zealand, Portugal, Slovakia, Spain, Switzerland, Turkey and the UK

key category analysis to many Parties⁹. In response, Denmark and Slovenia have integrated Tier 2 key category analysis in its 2010 submission, whereas Latvia aims to perform Tier 2 key category analysis for 2011 submission.

Table 5: Status of key category analysis

Tier 1		Tier 2	Tier 1 and 2
Australia	Hungary	Estonia	Denmark
Austria	Iceland	Finland	Ireland
Belgium	Latvia	Portugal	Italy
Bulgaria	Liechtenstein		Japan
Canada	Lithuania		Netherlands
Croatia	Monaco		Norway
Czech Republic	New Zealand		Slovenia
EU	Poland		Spain
France	Romania		Switzerland
Germany	Slovakia		USA
Greece	Sweden		

Note: Parties that are not included in the table imply that either the relevant information is not available or it is not clearly specified.

Source: NIR 2010 submissions

The major constraint to conducting Tier 2 level analysis is the lack of resources (1), especially necessary data. The Czech Republic voiced that Tier 2 analysis requires a large amount of data, which is by and large inaccessible (2).

3.3.2 Estimating methodology

Methodological choice for estimating emissions and removals is crucial in determining the quality of estimates. According to IPCC Good Practice Guidelines, higher Tier methods are encouraged where possible. The choice of methods used to estimate emissions and removals from LULUCF sector vary among Parties and land use categories. Most parties (9 Parties) use a combination of Tier 1, 2 and 3 levels for the calculation, followed by seven Parties each for a combination of Tier 2 and 3 and only Tier 1.

Thirteen Parties report having integrated Tier 3 method into their calculation and usually on the most significant categories, while seven Parties use only Tier 1 method (Table 6). Some Parties refrained from using a combination of higher Tiers for certain LULUCF categories due to the lack of data, as voiced by Latvia (32), Greece, Estonia and Czech republic. Greece, who also faced similar problem in its 2009 submission, developed a new database in response. Consequently, the more-up-to date data enables Greece to employ Tier 2 level estimation for certain categories of the LULUCF sector.

⁹ Latvia, Slovenia, Slovakia, Estonia, Czech Republic, France and Denmark

Estonia (12) as well as the Czech Republic (8) reveals that the Tier 3 method has not been implemented for the LULUCF sector due to the lack of adequate relationships with key data providers and hence the necessary data.

Table 6: Status of methodology selection

Tier 1	Tier 1 & 2	Tier 1 & 3	Tier 1, 2 & 3	Tier 2	Tier 2 & 3	Tier 3
Bulgaria Croatia Denmark Estonia Lithuania Monaco Switzerland	Czech Republic Greece Italy Latvia New Zealand Poland Romania	Austria Sweden	Canada EU Finland Iceland Ireland Norway Slovenia UK USA	France Germany Liechtenstein Netherlands Slovakia	Japan	Australia

Note: The choice of IPCC default and country-specific methodologies is not shown in the table. Parties that are not included in the table imply that either the relevant information is not available or it is not clearly specified.

Source: NIR 2010 submissions

Most parties using Tier 3 faced similar problems at some point, and report the implementation of national legislation and/or legal agreements in order to strengthen relationships with key data providers in order to secure the flow of necessary data in a timely manner. However, apart from the lack of data, the lack of national capacity to process the data is another key barrier, especially among the new EU member states (14). In response, the EU established an information and experiences sharing platform for forestry inventory among the member states, e.g. programmes under the “Contribution of forests and forestry to mitigate greenhouse effects”.

Similarly to the multilateral cooperation of the EU, each party also entered into bilateral cooperation at a national level in order to enhance national capacity to adopt higher tier method for LULUCF. Romania has entered into a bilateral project with the Netherlands GHG inventory team in order to enable the use of higher tier methods (36).

EF refers to a coefficient that relates the activity data to the amount of chemical compounds, which is the source of emissions. The majority of Annex I Parties (20 Parties) employ a mix of default and country-specific emission factors for the LULUCF sector. Seven parties employ only country-specific EFs and five Parties employ default EFs. Gaining country-specific EFs requires a research-intensive work; EFs are often based on a sample of measurement data, averaged to develop a representative rate of emission for a given activity level under a given set of operating conditions.

Table 7: Status of EF methodology

Default	Country-specific	Default & Country-specific	
Croatia	Australia	Austria	Italy
Estonia	Bulgaria	Czech republic	Lithuania
Japan	Canada	Denmark	New Zealand
Latvia	Liechtenstein	EU	Norway
Switzerland	Netherlands	Finland	Poland
	Sweden	France	Romania
	UK	Greece	Slovakia
		Hungary	Slovenia
		Iceland	Spain
		Ireland	USA

Note: Parties that are not included in the table imply that either the relevant information is not available or it is not clearly specified.

Source: NIR 2010 submissions

Where research on local conditions is insufficient, country-specific EFs are highly uncertain. In these cases, Parties are required to use the default EFs. As a solution, apart from more attention being paid to promote local research, some parties develop bilateral cooperation for EFs with Parties with similar conditions. For example, given the similar legal and geographical background, Liechtenstein entered into a treaty with Switzerland and adopts Swiss LULUCF EFs as those can represent the emissions more accurately than default EFs (37).

3.3.3 Quality management

Quality management consisting of QA and QC activities helps uncover errors of output via internal and external reviews. Each Annex I Party implements general inventory QC procedures (Tier 1) according to the UNFCCC reporting guidelines (38). Additionally, Annex I Parties apply Tier 2 category-specific QC procedures for key categories. QA procedures should be provided by personnel that have not been involved in the inventory development, preferably an independent third party, before submission of the inventory.

As regards QC, the majority of Annex I Parties (15 parties) employ Tier 1 QC procedures alone. Two parties use only Tier 2 procedures and 8 parties use a combination of Tier 1 and 2 procedures. Many parties conduct the QC procedures manually by using a checklist (Table 8). The responsibility of completing the list is primarily assigned to a leading agency of each sector. Alternatively, some parties¹⁰ use automatic QC checks,

¹⁰ Australia, Denmark, Germany, Latvia, Slovenia and the UK

which are embedded in their software for inventory management system. Such practice could help minimise potential human error. For example, Australia implements a system of automated Tier 1 controls within its inventory management system (22). Similarly, the UK has built numerous QA/QC procedures into its inventory management system (9).

Table 8: Status of quality management system

QC			QA			Quality system standard
Tier 1	Tier 2	Tier 1 & 2	2 nd party	3 rd party	Public	
Belgium Croatia Hungary Iceland Italy Japan Latvia Lithuania Monaco Netherlands New Zealand Romania Slovenia Spain Sweden	Slovakia Switzerland	Australia Austria Bulgaria Canada Germany Luxembourg Portugal USA	Australia Austria Belgium Bulgaria Canada Croatia Estonia EU Germany Iceland Japan Netherlands Slovakia Sweden	Austria Bulgaria Canada Denmark Estonia Finland France Germany Greece Iceland Japan Latvia <i>Luxembourg</i> Netherlands New Zealand <i>Romania</i> Slovakia <i>Spain</i> Switzerland <i>UK</i> USA	Estonia EU France Greece Latvia Netherlands Slovakia USA	Croatia Czech republic Denmark EU Greece Iceland Netherlands Slovakia Switzerland UK

Note: Parties that are not included in the table imply that either the relevant information is not available or it is not clearly specified.

Source: NIR 2010

Fourteen Parties employ 2nd Party audit¹¹ prior to the submission to the EU (for EU member states) and UNFCCC Secretariat (ERT review), for its 2010 submission. 19 parties report the use of 3rd Party audit¹² to conduct the QA activities (Table 8). Among those parties with 3rd Party audit, four Parties arrange a bilateral cooperation as part of their QA activities for LULUCF sector. For example, the QA activities of Luxembourg are performed by the support of experts from Austrian inventory agency. Similarly, the activities of the UK are based on the cooperation with GHG inventory team of France, and vice versa (34).

Lithuania and Slovenia, among other Parties without 2nd or 3rd Party audit, reveal that the 2nd Party audit cannot be performed due to the lack of national experts in LULUCF. Most of the national experts are already involved in the inventory preparation

¹¹ Personnel that is not involved directly in the inventory development to conduct QA activities

¹² External experts independent of the inventory preparation

(33). As for the 3rd Party audit, hiring external audit is not possible owing to national budget constraints (39).

Public review is essential for promoting the transparency of inventory development process. Seven Parties integrate a public review into their QA activities (Table 8). Generally the review publishes the inventory via a website within a given timeframe. For example, USA posts its draft inventory on the Environmental Protection Agency website, which is open to the entire US public, allowing for a 30-day comment period (40). Similarly, Latvia has recently established a public review procedure for its 2010 submission (32).

The development of a quality management system following an international standard is considered a means to improve and standardise the QA/QC system. 12 Parties implemented their quality management system following an international standard, primarily the ISO standard (Table 8). Several countries ¹³report the use of ISO 9001 standard. Similarly, Finland's quality management standard, which followed ISO 9001 certification, is under consideration (25).

3.3.4 Inventory management

According to the UNFCCC Guidelines (38), an inventory management system should ensure that all relevant inventory information for each year is available, allowing the reconstruction of the inventory by an expert review team. For archiving, Annex I Parties are encouraged to collect and gather the information in a "Single location".

26 Annex I Parties report the archiving generally for an entire inventory including LULUCF sector. Out of those who report, most Parties appear to have a centralised archiving and storage system to various extents commonly in forms of electronic files and hard copies and efforts have been made towards a single location for the system. On the other hand, Norway and Hungary specify that they archive and store parts of the LULUCF inventory separately in different locations. While Norway archives and stores LULUCF information in one location, Hungary seems to locate relevant LULUCF information in different entities.

¹³ Croatia, the Czech Republic, France, Greece, Iceland, Slovakia and Switzerland

In compliance with the existing institutional arrangements of the Party over the past decades, Norway archives and stores the inventory of LULUCF sector in one location – the Norwegian Forest and Landscape Institute – separate from other sector’s information. In Hungary due to the lack of national database for inventory, parts of the LULUCF inventory information thus are archived and stored at expert organisations, Research Institute and Forest Directorate. The Party however has plans to centralize the archiving and storage in the near future (10).

Three parties (Australia, Norway and New Zealand) adopt specific software to facilitate the inventory preparation and management of the LULUCF sector. Traditionally, the calculation of emissions and removals from the LULUCF sector is performed outside the database and is predominantly supported by Excel spreadsheets and Access databases. The use of software has advantages over traditional management as it integrates the necessary functions together: data collection (geospatial system), emissions and removals estimation and reporting application oriented for the UNFCCC requirement. Moreover it serves as a database for the entire LULUCF sector. A functional integrated system can assess the significance of data limitations that may be caused by omission or input errors (22).

For example, New Zealand’s system comprises primary applications for spatial data collection, QA/QC, emission estimation, reporting and archiving. The system provides a transparent means for validating the land-use data and producing the output required to populate the common reporting format tables for the LULUCF sector and reporting to the UNFCCC (29). As another example, the NCAS of Australia has an extensive QA/QC, verification and continuous improvement programs built in to improve accuracy, reducing potential human errors. The integration of agricultural and forests models helps minimise double counting or omissions in accounting (22).

A major barrier to the adoption is the lack of national capacity. According to Australia, the development of its LULUCF system has been labour-intensive: development of data inputs, building models, writing model software, QA/QC, model calibration, validation, verification, uncertainty and sensitivity. The diversity of agencies with specific expertise requires coordination to ensure consistent data inputs and outputs (22).

3.4 Summary

The current practices of LULUCF inventory preparation in Annex I Parties from the perspectives of legal, institutional and procedural arrangements are summarised as the following:

Legal instruments are often used for the purposes of creating and strengthening the institutions for the development of the LULUCF sector GHG inventory. The mandates for inventories have been extensively provided indirectly via the legislation for developing the national GHG inventory in over half of the Parties (22 Parties). The establishment of an entity with the mandate for the inventory specifically for the LULUCF sector is adopted in three Parties primarily via MOUs. To strengthen the LULUCF institution, legal commitments are adopted in ten Parties, primarily to gain good relationship with key data providers. National legislations are also adopted mainly by building on existing laws in three Parties. Supportive legal agreements for other purposes besides data collection are available in eight Parties. Evidence indicates the increasing use of such instruments in a long-term manner in the future.

The use of legal commitments is essential due to their comparative advantage, which is flexibility, over the national legislations. However, they lack permanence and the associated benefits. The use of instruments for a long-term period is therefore encouraged by the ERT.

The choice of institutional frameworks of six Parties greatly depends on their existing cooperation framework. The integration could enhance the efficient use of resources by helping to reduce overlapping responsibilities. 37 Parties identify the lead national inventory agency, and nearly half (18 Parties) clearly identify the lead agency of the LULUCF sector. Compiling an inventory for the LULUCF sector involves a number of different entities; lacking sufficient cooperation remains an issue of concern in three Parties. The governance mechanisms are put in place to enhance the coordination in 15 Parties. Evidence shows an increasing use of legal instruments to improve the relationship among involved entities in the future.

Though majority of the parties use Tier 1 for the key category analysis (22 Parties), quality control (15 Parties) and a mix of Tier 1, 2 and 3 estimating methodologies (eight Parties) and default and country-specific EFs (20 Parties), efforts

are being made to move towards higher tiers as well as country-specific EFs in the future. The majority of Parties have 3rd party audit (21 Parties) for QA. 8 parties perform public reviews. Ten Parties adopt an international standard for the quality management system. Over half of Parties (24 Parties) have a single location to archive and store LULUCF inventories and evidence shows an increasing adoption of the single location practice. The use of software for the preparation and management of the GHG inventory of the LULUCF sector is present in three Parties. There are significant advantages to a centralised database with built-in data collection, processing, calculation and reporting with an extensive automate QA/QC and verification, with software offering significant potential for improving inventory accuracy.

The analysis reveals that most Parties are committed to improving the legal, institutional and procedural arrangements of their GHG inventory for the LULUCF sector. Apart from the necessity to prepare the inventory annually, additional drivers are international, regional and national facilitation. The ERT has provided Annex I Parties with specific recommendations for improvement and has monitored the corresponding improvement on a continuous basis. Regionally, the EU has facilitated the improvement for its member states particularly the new ones by providing reviews, a platform for experience exchange and facilitative software. The EU also reviews the member states' national inventory and monitors the improvement on an annual basis. Nationally, the national legislations stipulate that the development of the inventory as well as data collection facilitate relevant entities in developing and improving the national inventory on a continuous basis.

Despite the efforts to improve, Annex I Parties also encountered difficulties; generally they possess insufficient national capacity, data are inaccessible and they are financially constrained.

4 NATIONAL SYSTEMS FOR GHG INVENTORY IN NON-ANNEX I PARTIES

Based on the same set of indicators and parameters, this section provides the analysis of national system of the GHG inventory for the LULUCF sector in non-Annex I Parties. The analysis is divided into legal, institutional and procedural arrangements.

4.1 Legal arrangements

The mandate for the GHG inventory of the LULUCF sector as well as for the data collection and other procedures during the planning, preparation and management are discussed. Details of the arrangement of each Party are illustrated in Appendix 4.

4.1.1 Mandate for the GHG inventory for the LULUCF sector

Development of the GHG inventory for the LULUCF sector is undertaken by the national entity responsible for national GHG inventory development, which includes the LULUCF sector. Out of seven Parties discussing about the mandate for national GHG inventory development, four Parties have established an entity with a clear mandate for the development. A direct mandate specifically for the LULUCF sector is present in one Party; the responsibility is assigned to a consultancy firm (Table 9).

Table 9: Status of mandate for the GHG inventory of LULUCF sector

No mandate for NIR	Mandate for NIR	Mandate for LULUCF
Botswana Costa Rica Sudan	Equatorial Guinea Gabon Sri Lanka Malawi	South Africa

Note: Parties that are not included in the table imply that either the relevant information is not available or it is not clearly specified.

Source: Completed questionnaires for the Workshop

In Botswana, the lack of a legal framework has lead to the absence of resources necessary for the development of the inventory, especially with regard to trained staff. The Party has national experts with skills to meet the demanding inventory work but not all of them can participate in the development of the national GHG inventory as they have mandatory duties to perform in their institutions (41). A similar situation is reported

in Guyana and the Philippines. Since the development of inventory is not mandatory, staffs on routine non-inventory assignments are asked to take on additional responsibilities without sufficient resources, i.e. budget for data collection, computer systems and relevant software, trained staff, to perform the inventory assignment (42). In the Philippines, the preparation of the national inventory is not regarded as mandatory function of the relevant authority. This leads to difficulties in developing the inventory; even when data are available, there are insufficient human resources to produce the inventory. As a result, it has not been possible to prepare the inventory on a continuous basis (43).

4.1.2 Mandate for LULUCF data collection and other purposes

Among the procedures of the LULUCF inventory development, the efforts are primarily focused on data collection via the national forest inventory (NFI). The NFIs are robust systems to assess carbon stock changes in forestland. Many parties have based the development of the GHG inventory for the LULUCF sector on their NFIs (44).

Table 10: Status of mandate for NFI

No mandate for NFI	Mandate for NFI
Bangladesh	Bolivia
Botswana	Colombia
Burundi	DR Congo
Central African Republic	Ecuador
Costa Rica	Gabon
Equatorial Guinea	Kenya
South Africa	Mexico
Sri Lanka	Nepal
	Panama
	Papua New Guinea
	Sudan

Note: Parties that are not included in the table imply that either the relevant information is not available or it is not clearly specified.

Source: Completed questionnaires

Eleven Parties have established an entity with a mandate to compile a NFI, which helps support the estimation of emissions and removals in the LULUCF sector (Table 10). Primarily, the establishment is enabled by international support for forest monitoring capacity building. According to the UNFCCC (44), over 20 non-Annex I parties have developed the national forest resource assessment program, developed in collaboration with the Food and Agriculture Organization (FAO) Forest Department.

Eight Parties report that they do not have such mandate in place. South Africa however reveals its intention to implement one in the near future. The intention is driven by the urge to build national capacity. Initially, the party has employed an external consultancy firm to undertake the NFI as well as the GHG inventory for the LULUCF sector. However it was done without informing the government inventory team. The Party thus plans to establish an operational unit with the mandate for forest inventory preparation by forming an inter-ministerial working group on LULUCF to build in-house capacity, thereby reducing the reliance on the consultancy firm.

Botswana and Sri Lanka, lacking the NFI mandate and arrangement for data collection, also have insufficient forest-related activity data. Botswana lacks data in land representation and forest fires and thus has high uncertainty in their forest carbon estimations. Similarly, Sri Lanka encountered difficulties in accessing forest-related data, e.g. land representation, forest fire, forest carbon etc. The use of legal instruments for other means of data collection as well as other purposes is not reported.

4.2 Institutional arrangements

Institutional arrangements comprise the structural framework for the development of the GHG inventory for the LULUCF sector as well as the relationship between different agencies and organizations involved in the process. The arrangement of principal agencies – lead agencies for the development of the national GHG inventory and the LULUCF sector – and institutional structure as well as institutional relationship among involved entities are discussed. Details of the arrangement of each Party are illustrated in Appendix 5.

4.2.1 Lead agency of the national GHG inventory

In most Parties, there is a lead agency for compiling national inventory under the supervision of the reporting agency, which is an agency with the responsibility for reporting the national GHG inventory to the UNFCCC Secretariat. Nine Parties however have a lead agency, which also performs a reporting role for the national GHG inventory. Although the position of the lead agency of the LULUCF sector is often delegated to other entities with sectoral expertise, the lead agency for the national GHG inventory

development has a direct supervisory role and responsibility for monitoring the national GHG inventory for the LULUCF sector.

Thirteen Parties have an entity with overall responsibility for preparing the national GHG inventory, which covers the LULUCF sector. In most Parties, there is a lead agency compiling national inventory under the supervision of the reporting agency, which is an agency with the responsibility for reporting the national GHG inventory to the UNFCCC Secretariat. Seven Parties however have a lead agency, which also performs a reporting role of the national GHG inventory. All Parties except one have one agency performing the lead role; Nepal has two lead agencies working in collaboration for the inventory development: a government agency and university.

The lead agency for the national GHG inventory position is generally assigned to a central government agency. Table 11 reveals that nine Parties have a government agency as the lead agency, while one, two and two Parties have research institute, universities and consultancy firms as the lead agency, respectively. The selection of the lead agency depends on the nature of the Party’s national system. For example, Sri Lanka and Malawi hired a consultancy company to lead the inventory, and therefore the monitoring role, on an ad-hoc basis. This owes to the lack of a formal inventory system and permanent inventory team.

Table 11: Type of lead agency of national GHG inventory

Government agency	Research institute	University	Consultancy firm
<i>Bhutan</i> <i>Cambodia</i> <i>Costa Rica</i> <i>Equatorial Guinea</i> <i>Indonesia</i> <i>Nepal</i> <i>South Africa</i> <i>Sudan</i> <i>Vietnam</i>	<i>Tanzania</i>	<i>Botswana</i> <i>Nepal</i>	<i>Sri Lanka</i> <i>Malawi</i>

Note: Parties that are not included in the table imply that either the relevant information is not available or it is not clearly specified.

Source: National communications and completed questionnaires

4.2.2 Lead agency of the GHG inventory for the LULUCF sector

In most Parties, the lead agency for the national GHG inventory development often allocates the technical development of the LULUCF sector to sectoral experts in government agencies, research institutes, universities and consultancy firms. However for

three Parties, this is not the case, as the lead agencies of the national GHG inventory do not delegate the work; instead they assume an additional role as the lead agency of the LULUCF sector. On the other hand, ten parties reveal that they appoint another entity as the lead agency for the LULUCF inventory.

While most Parties have one agency to perform the lead position for the LULUCF sector, Costa Rica and Gabon have two and three different entities as the lead agency respectively. The parties separate the work on LULUCF into two parts: land-use and land-use change and forestry inventories. For example, in Gabon the Environment General Direction and Agriculture General Direction are responsible for the development of the GHG inventory of the agriculture and land-use and land-use change sector, whilst Forestry and Water Affairs is responsible for the forestry sector.

Table 12: Type of lead agency for the LULUCF sector

Government agency	Research institute	University	Consultancy firm
Bhutan Cambodia Costa Rica Gabon Vietnam	<i>Tanzania</i> Costa Rica	Sudan	South Africa <i>Sri Lanka</i> <i>Malawi</i>

Note: Parties that are not included in the table imply that either the relevant information is not available or it is not clearly specified.

Source: National communications, completed questionnaires and GOF-C-GOLD (5)

50% of Parties (5 Parties) report the allocation of work to government agencies, whilst two, one and three Parties delegate the responsibility to research institutes, university and consultancy firms, respectively (Table 12). Similar to the selection of the lead agency for the national inventory, the selection is determined greatly by the nature of the party's national system. For example, South Africa employs an external consultant to perform the lead role on an ad-hoc basis, since there is no formal national inventory system. Moreover, the skills in the LULUCF sector of the inventory agency remain inadequate. As a result, consultants conduct the LULUCF inventory as well as data collection, e.g. NFI.

4.2.3 Institutional structures and relationships

General information on the structure of the inventory system for the LULUCF sector is limited. It is likely that this owes to the absence of formal national inventory

system in many Parties. Seven Parties¹⁴ report that there is no formal national inventory team and the inventory has been done on an ad-hoc basis. Gabon reports that its national system for LULUCF functions on a temporary basis: the national inventory unit as well as the forestry inventory unit, which is responsible for compiling national forest inventory. This is because the national inventory system is provisional upon the need to prepare national communication to the UNFCCC.

Without the formal team structure and continuous inventory exercise, a lack of coordination and information sharing between agencies is widely reported. Bhutan emphasizes the need for a well-coordinated system, which engages all relevant agencies (45). The primary concern regarding the present arrangement is the lack of good institutional relationships with technical experts and key data providers. For example, in Vietnam as well as Costa Rica, inter-agency coordination with technical experts is needed since it does not have a large enough pool of experts in individual government agencies (46). Regarding data collection, Cambodia also reveals similar weak coordination and recognizes the need for inter-agency cooperation to ensure necessary data collection and compilation for the inventory (47).

4.3 Procedural arrangements

Procedural arrangements consist of activities undertaken to produce the GHG inventory for the LULUCF sector. The practice of key category analysis, estimating methodology, quality management and inventory management, including archiving, are discussed. Details of the arrangement are illustrated in Appendix 6.

4.3.1 Key category analysis

Eleven Parties discuss the practice of key category analysis performed for all sectors, including LULUCF. According to the UNFCCC (48), non-Annex I Parties are encouraged to undertake key category analysis in order to better reflect their national circumstances. However, out of eleven Parties, five of them report the absence of key category analysis for the national GHG inventory, including the LULUCF sector. One

¹⁴ Botswana, Equatorial Guinea, Gabon, Sri Lanka, Sudan, South Africa and the Philippines

Party takes a qualitative approach to the key category analysis: Solomon Islands base its analysis solely on expert judgment. Three Parties take a quantitative approach, using Tier 1 level methodology. Two parties report the mix of quantitative and qualitative approaches for the analysis.

Table 13: Status of key category analysis

Not perform	Qualitative	Quantitative (Tier 1)	Qualitative and quantitative
Sudan Sri Lanka Equatorial Guinea Malawi Nepal	Solomon Islands	Bolivia Costa Rica Vietnam	Gabon South Africa

Note: Parties that are not included in the table imply that either the relevant information is not available or it is not clearly specified.

Source: National communications and completed questionnaires

4.3.2 Quality management

Quality management systems help uncover errors of output via internal and external reviews. None of the non-Annex I parties report the QA/QC activities, except for Bolivia, which reveals the performance of QC activities (49). A potential barrier to QA procedures may well be inadequate financial resources as the procedure involves 3rd Party review. Furthermore, online public review, a form of external review, is not possible in many Parties¹⁵ due to the lack of information technology expertise and financial resources to establish and maintain the website. The QC activities can be restrained by an inadequate number of personnel perform the activities. This primarily roots from the fact that national GHG inventory development, including for the LULUCF sector, is not mandated as responsibilities and functions of the inventory agency.

4.3.3 Estimating methodology

Methodological choice for emissions estimation is crucial in determining the quality of data output. According to the IPCC GPG (50), higher tier methods are encouraged where possible. Only two Parties report the methodology used for estimation and they both use Tier 1 methodology for the LULUCF sector (5).

According to the UNFCCC (48), non-Annex I Parties are encouraged to use their country-specific and regional EFs as they are more appropriate and accurate than the

¹⁵ Botswana, Equatorial Guinea, Malawi, Nepal, Sudan, Sri Lanka and South Africa

default data. Most Parties however use IPCC default values for EFs of the LULUCF sector. Only Bangladesh and Cambodia attempt to adjust IPCC default value towards country-specific conditions. The absence of local emission factors is due to insufficient lack of experts and resources to support the research on the development of the factors.

4.3.4 Inventory management

Inventory management covers the process of data handling, analysis, archiving and storage. According to the UNFCCC (48), non-Annex I Parties are encouraged to undertake and describe arrangements to collect and archive data for the preparation of national inventories, allowing the reconstruction of inventories and the continuity of the process

Table 14: Status of inventory management activities

Archiving		Specific Software	
Not perform	Perform	Not available	Available
Equatorial Guinea Nepal	Botswana Costa Rica Gabon South Africa Sudan	Botswana Equatorial Guinea South Africa Sri Lanka Gabon Sudan	

Note: Parties that are not included in the table imply that either the relevant information is not available or it is not clearly specified.

Source: National communications and completed questionnaires

Archiving in non-Annex I Parties remains limited. It is conducted by five Parties (Table 14). While Botswana archives in only hard copy version, South Africa, Gabon and Costa Rica archive in both electronic and hard copy formats. Other non-Annex I Parties included in this analysis do not provide information on the inventory management system, except for two parties that specifically report the absence of archiving of their inventories. It is likely that the main barrier to archiving is the lack of inventory databases. Bolivia is the only Party using a database for inventory management.

The adoption of specific software for the preparation and management of the LULUCF sector or the entire national GHG inventory is not reported in non-Annex I Parties. Traditional software, generally in forms of Excel spreadsheets and Access

database, are used, as revealed by 6 Parties (Appendix 6). The major obstacle for the adoption of specific software may well be the lack of technical capacity, which is necessary for development and maintenance of the software.

4.4 Summary

Current practices for the development of GHG inventories for the LULUCF sector in non-Annex I Parties from legal, institutional and procedural arrangements and perspectives are summarized as follows:

The use of legal instruments remains limited among the non-Annex I Parties, four Parties report the mandate for the national GHG inventory development and hence the LULUCF sector. A direct mandate is provided to consultancy firms in three Parties to assume the task of development of the GHG inventory for the LULUCF sector. Eleven Parties establish an entity with the mandate for the development of the NFI, primarily enabled by international support. The use of legal instruments for other data collection and purposes is not reported. Concerning institutional arrangements, 13 Parties have the lead agency of the national GHG inventory and ten Parties have the lead agency of the LULUCF sector. While most of them have one lead agency for the LULUCF sector, two Parties have two or three different agencies performing the role. Institutional relationships are lacking since in many parties the preparation and hence institution of LULUCF is temporary and arranged on an ad-hoc basis. Regarding procedural arrangements, at least five Parties do not perform key category analysis. QA/QC is not reported. Only two Parties reveal the use of Tier 1 methodology and the use of country-specific EFs. No parties report the use of specific software for developing the GHG inventory of the LULUCF sector.

Strong commitment to improve LULUCF inventory as seen in Annex I Parties for the past decade is deemed lacking in many non-Annex I Parties. Major barriers can be identified as the following areas: inadequate legal frameworks of leading institutions, and shortcomings in technical capacity, data availability and financial resources.

5 CONCLUSIONS AND RECOMMENDATIONS

Evidence shows that non-Annex I Parties are facing a number of problems, gaps and constraints as regards the preparation of the GHG inventory for the LULUCF sector. Common difficulties can be specified as the following: inadequate legislative frameworks, institutional instability, weak coordination, inadequate technical capacity, data unavailability and financial constraints.

The analysis of Annex I Parties reveals that the Parties are also faced with similar difficulties, however to a lesser extent. Based on the cumulative experiences in preparing the inventory and overcoming the difficulties – general and specific recommendations are proposed for non-Annex I Parties.

The proposed generic recommendations are the improving legislative frameworks, strengthening of institutional stability and institutional coordination, enhancing technical capacity, securing data availability and conducting financial plans. The detailed recommendations are the following:

1) Improving legislative framework

From the perspective of legal arrangements, non-Annex I Parties generally do not have adequate supportive legal instruments in place to conduct the inventory. This reflects the low level of awareness about the value of the inventory among politicians and decision-makers. To illustrate, in certain Parties many private organizations and government agencies, particularly the Forest department, were not aware of the importance of the linkage between their organisations and the inventory development. Moreover, their national legislations have not supported the development of GHG inventory for the LULUCF sector (51).

Based on the findings, awareness raising initiatives should be considered particularly among politicians and decision-makers. The gained understanding would ease the implementation of legal instruments in support of the development of inventories for the LULUCF sector. Furthermore, existing national legislative frameworks should be reviewed in light of potential opportunities to exploit existing shortcomings. Together, legal instruments can be implemented the requisite area and help ensure the flow of

quality data, technical expertise and financial resources, which are necessary for compiling the inventory, in a timely manner.

The choice of instruments should be considered according to the importance of the purpose of the agreement. Lessons from Annex I Parties show that legal commitments, e.g. contracts and MOUs should be considered, where it is impossible to exploit the existing legal framework. This approach capitalises upon the benefits of national legislations, while enjoying the advantages of the legal commitments by implementing the instruments in a long-term manner.

2) Ameliorating institutional stability

Many Parties do not have a formal system for GHG inventory development in place. The absence of institutional relationships as a consequence has prevented Parties from developing inventories on a continuous basis and building capacity of the team, which is an inherent part of learning from experience. Furthermore, weak institutional relationships among the involved agencies, particularly regarding key data providers has severely obstructed the compilation of the inventory.

To develop an inventory system of the LULUCF sector, the generic model similarly to those of Annex I Parties comprises of two lead agencies: for the national GHG inventory and the LULUCF sector. The former is responsible for central archiving, QC and reporting the emission estimations to the UNFCCC Secretariat for further review, and the latter for QC and inventory compilation for the LULUCF sector. The model also includes supporting units for preparing data inputs (GIS and remote sensing), NFI, developing models for emissions estimation, using models to estimate, report and archive the emissions from the LULUCF sector as well as independent experts, to perform QA and verification in order to enhance reliability of the inventory.

Linking the inventory system to REDD+, the model as illustrated in Figure 7 serves as an option. The proposed system comprises four main agencies. REDD+ coordination (Agency A) is responsible for all REDD+ activities, including the GHG inventory for forestry. The coordination assigns the reporting obligation of the GHG inventory for forestry to Agency A. Potentially, Agency A can be under direct supervision of the head of the state or the Prime Minister in order to enhance credibility

and reliability of the estimation. In a simplified version, Agency A can also be the same entity as Agency B, which has an overall responsibility for the national GHG inventory development. Amongst different agencies developing the GHG inventory for the LULUCF sector, Agency C and D are responsible for different key data collection for the NFI and land-use respectively, however they are highly relevant and interdependent. While the land-use data can be helpful for the stratification of forestland for NFI, the NFI data collected is proven useful for ground-truthing of land-use data. Independent experts conduct QA procedures and verification. Additionally, this proposal suggests for the independent review to be performed in a similar manner as the ERT review in order to verify the transparency, consistency, comparability, completeness and accuracy of the submitted data for the non-Annex I Parties.

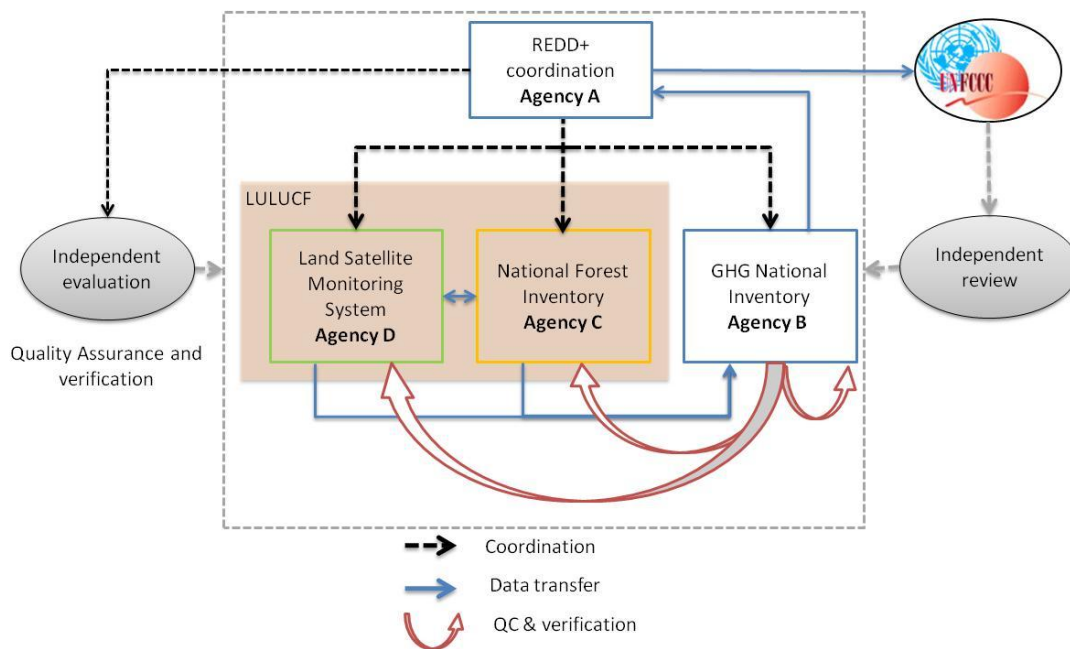


Figure 7: Model of national inventory system in the context of REDD+

To strengthen the relationship among institutions, legal instruments can be as effective tools. They nonetheless should be complemented with governance mechanisms such as working groups, steering committees and advisory boards in order to drive improvement of the inventory and ensure timely inventory preparation.

3) Technical capacity building

The lack of trained human resources and technical expertise in the LULUCF sector has restricted many Parties from developing their GHG inventory for the LULUCF sector. An inadequate number of experts to develop the inventory is one of the common problems in this area, since they have already existing responsibilities not relevant to the inventory.

Another common problem is the lack of sufficient national capacity to carry out the inventory. Though Landsat data is commonly used and is free-of-charge, it remains constrained primarily due to the lack of receiving stations and persistent cloud cover. The SPOT¹⁶ and ASTER¹⁷, among other data sources to complement or substitute Landsat data, have also been used since near-global archived observations exist, but they are costly to acquire thus unaffordable to certain Parties (5). As a result, Gabon for example has no map of its forest cover or land use change owing to the lack of in-house remote sensing capacity (52).

To bridge this capacity gap, legislative frameworks should be implemented to assign an entity with appropriate technical capacity with the mandate to develop the GHG inventory for the LULUCF sector. Long-term employment along with capacity building and training programs should be provided in order to ensure that the inventory team has sufficient knowledge of the dynamic technical elements of the LULUCF inventory to carry out its respective tasks in an efficient and timely manner.

Moreover, bilateral or regional cooperation should be promoted, as it could ensure efficient use of resources and help overcome specific difficulties such as the lack of receiving stations, persistent cloud-cover and seasonality. The cooperation should not be limited to only between the 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 forest inventory, e.g. India, Brazil, Mexico, to engage in regional cooperation for capacity development.

¹⁶ Satellite Pour l'Observation de la Terre

¹⁷ Advanced Spaceborne Thermal Emission and Reflection Radiometer

4) Data availability

Data constraints and gaps have presented a major barrier to the development of the GHG inventory for the LULUCF sector in many Parties. Most of the time, adequate data is not available. When it is available, it often comes in an inappropriate format. As a result, the estimation of emissions and removals of LULUCF sector of many Parties has high level of uncertainty. There are several factors responsible for the problem. The lack of supportive frameworks, institutional relationships and technical capacity, as discussed above, needs to be addressed in the specific context of data collection.

To address the information gap, Parties should firstly identify required data and useful data sources. Secondly, they should establish legal instruments for data collection and reporting. Thirdly, they should train involved personnel on methods and techniques of data collection, reporting and management. The adoption of integrated software for the LULUCF sector as practiced in Annex I Parties should be considered. The software with automated data collection, calculation, QC and reporting functions can serve as means to improve comparability and minimise errors and hence uncertainty of the estimates. Lastly, the creation and maintenance of a web-based database should be promoted to facilitate reporting and accessibility of data.

5) Conducting financial plan

The financial issue has not been voiced as the prime concern in many non-Annex I Parties at present, since the GEF generally finances the inventory preparation. Such financial dependence on international partners is however unsustainable in a long-term.

Non-Annex I Parties should maximize the international support while mobilising domestic funds. The development of long- and medium-term financial plans for the development of the GHG inventory should be conducted as means to maximise international support. At the same time, the party should mobilise domestic funds from all economic sectors to effectively improve and implement the GHG inventory on a continuous basis. Following the path of Annex I Parties, the financial burden for preparing the inventory should be shared when possible via cost-effective collaboration, e.g. bilateral or regional programs, aiming to develop or improve country-specific or regional EFs, activity data and calculating methodologies.

6 REFERENCES

1. Ministry for Environment of New Zealand. (2008) New Zealand A submission to the Ad hoc Working Group on Long term Cooperative Action under the Convention Measurable, reportable and verifiable actions.
2. Johann Heinrich von Thünen-Institut - Institute of Forest Ecology and Forest Inventory. (2010) Capacity Development for REDD+ Establishing National GHG Inventory Systems.
3. Baker, D. J., Richards, G., Grainger, A., Gonzalez, P., Brown, S., DeFries, R., Held, A., Kellndorfer, J., Ndunda, P., Ojima, D., Skrovseth, P., Souza Jr., C., and Stolle, F. (2010) Achieving forest carbon information with higher certainty: A five-part plan, *Environmental Science and Policy* 13, 249-260.
4. United Nations Framework Convention on Climate Change. (2010) Non-Annex I National Communications, 30 June 2010, UNFCCC.
5. Herold, M. (2009) An assessment of national forest monitoring capabilities in tropical non-Annex I countries: Recommendations for capacity building, GOFCC-GOLD, the Government of Norway.
6. United Nations Framework Convention on Climate Change. (2005) Guidelines for national systems under Article 5, paragraph 1 of the Kyoto Protocol, UNFCCC, Bonn.
7. Federal Environment Agency of Germany. (2010) National Inventory Report for the German Greenhouse Gas Inventory 1990-2008, Federal Environment Agency of Germany, Dessau.
8. Czech Hydrometeorological Institute. (2010) National Greenhouse Gas Inventory Report of the Czech Republic, CHMI Prague.
9. AEA Technology plc. (2010) UK Greenhouse Gas Inventory 1990-2008, Department of Energy and Climate Change of the UK, Didcot.
10. Hungarian Meteorological Service. (2010) National Inventory Report for 1985-2008, Hungarian Meteorological Service.
11. Umweltbundesamt. (2010) Austria's National Inventory Report, Umweltbundesamt GmbH, Vienna.
12. Ministry of Environment of Estonia. (2010) Greenhouse Gas Emission in Estonia 1990-2008, Ministry of Environment, Tallinn.
13. Swedish Environmental Protection Agency. (2010) National Inventory Report 2010, Swedish EPA, Stockholm.
14. European Commission, and European environmental Agency. (2010) Annual European Union Greenhouse Gas Inventory 1990-2008 and Inventory report 2010, European Commission, Brussels.
15. Netherlands Environmental Assessment Agency. (2010) Greenhouse Gas Emissions in the Netherlands 1990-2008, PBL, Bilthoven.
16. Environment Agency of Luxembourg. (2010) Luxembourg's National Inventory Report, Environment Agency, Luxembourg.
17. Institute of Environmental Protection. (2010) Poland's National Inventory Report 2010, Institute of Environmental Protection, Warszawa.

18. Agencia Portuguesa do Ambiente. (2010) Portuguese National Inventory Report on Greenhouse Gases 1990-2008, Agencia Portuguesa do Ambiente, Amadora.
19. Ministry of Environment and Rural and Marine Affairs. (2010) Greenhouse Gas Emissions Inventory of Spain 1990-2008, Ministry of Environment and Rural and Marine Affairs, Madrid.
20. Federal Office for the Environment. (2010) Switzerland's Greenhouse Gas Inventory 1990-2008, FOEN, Bern.
21. Climate and Pollution Agency of Norway. (2010) National Inventory Report 2010: Greenhouse Gase Emissions 1990-2008, Climate and Pollution Agency of Norway.
22. Department of Climate Change and Energy Efficiency of Australia. (2010) Australian National Greenhouse Accounts, Department of Climate Change and Energy Efficiency, Canberra.
23. Environment Canada. (2010) National Inventory Report 1990-2008, Ministry of the Environment.
24. Inter Regional Cell for the Environment of Belgium. (2010) Belgium's Greenhouse Gas Inventory (1990 - 2008), Inter Regional Cell for the Environment (IRCL), Brussels.
25. Statistics Finland. (2010) Greenhouse Gas Emission in Finland 1990-2008, Statistics Finland.
26. Environment Agency of Iceland. (2010) National Inventory Report 2010, Environment Agency of Iceland, Reykjavik.
27. Istituto Superiore per la Protezione e la Ricerca Ambientale. (2010) Italian Greenhouse Inventory 1990-2008, Istituto Superiore per la Protezione e la Ricerca Ambientale,, Rome.
28. National Institute for Environmental studies. (2010) National Greenhouse Gas Inventory Report of Japan, National Institute for Environmental studies, Ibareka.
29. Ministry for the Environment of New Zealand. (2010) New Zealand's Greenhouse Gas Inventory 1990-2008, Ministry for the Environment of New Zealand, Wellington.
30. Slovak Hydrometeorological Institute. (2010) National Inventory Report 2010, Ministry of the Environment, Bratislava.
31. Turkish Statistical Institute. (2010) National Inventory Report, Turkish Statistical Institute, Ankara.
32. Latvian Environment Geology and Meteorology Center. (2010) Latvian National Inventory Report 1990-2008, LEGMC, Riga.
33. Enviornment Agency of the Republic of Slovenia. (2010) Slovenia's National Inventory Report 2010, Ministry for Environmental and Spatial Planning, Ljubljana.
34. Centre Interprofessionnel Technique d'Etude de la Pollution Atmospheric . (2010) Rapport National d'Inventaire pour la France au Titre de la Convention Cadre des Nations Unies sur les Changements Climatiques et du Protocole de Kyoto CITEPA, Paris.
35. National Environmental Research Institute of Denmark. (2010) Denmark's National Inventory Report, NERI.

36. National Environmental Protection Agency of Romania. (2010) National Inventory Report 2010, Ministry of Environment and Forests.
37. Office of Environmental Protection of Leichtenstein. (2010) Leichtenstein's Greenhouse Gas Inventory 1990-2008, OEP, Vaduz.
38. United Nations Framework Convention on Climate Change. (2006) Reporting Guidelines on Annual Inventories following Incorporation of the Provisions of Decision 14/CP.11, UNFCCC, Bonn.
39. Ministry of Environment of Lithuania. (2010) National Greenhouse Gas Emission Inventory Report 2009 of the Republic of Lithuania, Ministry of Environment, Vilnius.
40. Environmental Protection Agency of USA. (2010) Inventory of U.S. Greenhouse Gas Emissions and Sinks, US EPA, Washington D.C.
41. Food and Agriculture Organization. (2011) Questionnaire on National System and GHG Inventory for the Workshop, Rome.
42. National Climate Committee and Natural Resources and Environment Advisory Committee of Guyana. (2002) Initial National Communication in response to its commitments to the UNFCCC, National Climate Committee, Natural Resources and Environment Advisory Committee and UNDP, Georgetown.
43. Global Environment Facility, United Nations Development Programme. (1999) The Phillipines' initial national communication on climate change, UNDP, Manila.
44. United Nations Framework Convention on Climate Change. (2009) CD-REDD: Capacity Development for Reducing Emissions from Deforestation and Forest Degradation, UNFCCC, Bonn.
45. National Environment Commission of Bhutan. (2000) Initial National Communication under the UNFCCC, Kuensel Corporation, Thimphu.
46. Ministry of Natural Resources and Environment of Vietnam. (2010) Vietnam's second national communication to the UNFCCC, Ministry of Natural Resources and Environment, Ha Noi.
47. Ministry of Environment of Cambodia. (2002) Cambodia's Initial National Communication under the UNFCCC, Ministry of Environment, Phnom Penh.
48. United Nations Framework Convention on Climate Change. (2002) Guidelines for the preparation of national communications from Parties not included in Annex I to the Convention, UNFCCC, Bonn.
49. Ministerio de Medio Ambiente y Agua. (2009) Second National Communication, Ministerio de Medio Ambiente y Agua, La Paz.
50. Intergovernment Panel on Climate Change. (2003) Good Practice Guidance for Land Use, Land-Use Change and Forestry, IGES, Hayama.
51. Ministry of the Environment and Conservation of Papua New Guinea, and UNDP. (2000) Initial national communication under the UNFCCC, Ministry of the Environment and Conservation, Port Moresby.
52. Ministere de l'Environnement et de la protection de la nature. (2004) Communication nationale sur les changements climatiques, Ministere de l'Environnement et de la protection de la nature of Gabon, Libreville.

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Appendix 1: Legal arrangements of Annex I Parties

Party	Mandate for national GHG inventory	Mandate for LULUCF sector	Legal instruments for data collection	Other legal instruments
Australia	NA	NA	MOU	NA
Austria	- Environmental Control Act - Austrian Emissions Certificate Trading Act	NA	NA	Environmental Control Act
Belarus	In Russian			
Belgium	NA	NA	NA	NA
Bulgaria	- Environmental Protection Act - Regulation on the organization and structure of ExEA - Order № 110/30.04.2010 by the Executive Director of ExEA - Order № RD 218/05.03.2010 by the Minister of Environment and Water	NA	NA	Contract: calculation
Canada	- 1999 The Canadian Environmental Protection Act (CEPA)	NA	MOU	NA
Croatia	- Air Protection Act	Contract	NA	NA
Czech Republic	NA	NA	- Act No. 265/1992 Coll., on Registration of proprietary and other material rights to real estate - Act No. 344/1992 Coll., on the real estate cadastre of the Czech Republic	NA
Denmark	NA	NA	NA	NA
Estonia	- Ambient Air Protection Act	NA	Formal agreement	Formal agreement: QA/QC, archiving
EU	NA	NA	NA	NA
Finland	- Statistics Finland Act - Statistics Act	Formal agreement	NA	NA
France	- Ministerial Order of 29 December 2006 concerning the National Air Pollutant Emissions Inventory System (SNIEPA)	NA	NA	NA

Party	Mandate for national GHG inventory	Mandate for LULUCF sector	Legal instruments for data collection	Other legal instruments
Germany	- Directive 11/2005 of the Federal Environment Agency - State secretaries' resolution of 5 June 2007	State-secretary Resolution of 22 December 2006	Formal agreement Reporting obligation	Formal agreement: calculation
Greece	- Decree on data provision relating to GHG emissions (No. 345/2009)	NA	NA	NA
Hungary	- Act No. 65 from 2007 on the emission of greenhouse gases	NA	Act LX of 2007	Finances Act
Iceland	- Environmental Protection Agency Act of 1992 - 2007 Government Decision on the establishment of National Inventory System	NA	Formal agreement	NA
Ireland	- Legislative Decree 51 for National System for GHG Inventory	NA	MOU	MOU: calculation
Italy	NA	NA	NA	NA
Japan	NA	NA	NA	NA
Latvia	- Regulation No. 157	NA	NA	NA
Liechtenstein	NA	NA	NA	NA
Lithuania	NA	NA	NA	NA
Luxembourg	- Grand-Ducal Regulation 10 - Law of 27 November 1980 on Environment Agency	NA	NA	Contract: QA/QC, uncertainty analysis
Monaco	In French			
Netherlands	NA	NA	Contract	NA
New Zealand	- The Climate Change Response Act	NA	Contract Formal agreement	Contract: QA/QC
Norway	NA	NA	NA	NA
Poland	- Act of 17 July 2009 on the system to management the emissions of greenhouse gases and other substances - Act on Environmental Protection and some other Laws	NA	NA	NA
Portugal	- Council of Ministers Resolution 68/2005, of 17 March	NA	NA	NA
Romania	- Governmental Decision no. 1570 for establishing the National System - Governmental Decision no. 1570/2007	NA	NA	NA
Russia	In Russian			

Party	Mandate for national GHG inventory	Mandate for LULUCF sector	Legal instruments for data collection	Other legal instruments
Slovakia	- Decision of the Ministry of Environment of the Slovak Republic on 1st January 2007	NA	NA	NA
Slovenia	NA	NA	NA	NA
Spain	- Ministerial Order MAM/1,444/2006	NA	NA	NA
Sweden	NA	NA	NA	MOU: calculation
Switzerland	- Ordinance on the Internal Organization of DETEC of 13 December 2005	NA	NA	NA
Turkey	NA	NA	NA	NA
Ukraine	In Russian			
UK	NA	Contract	Contract	Contract: calculation
USA	NA	NA	NA	NA

Abbreviations:

NS- The practice is performed but not clearly specified

NA- Relevant information is not available implies that the practice is not performed or performed but is not reported

D- IPCC Default, T1- IPCC Tier 1, T2- IPCC Tier 2, T3- IPCC Tier 3, CS- Country specific, CR- CORINAIR methodology

Appendix 2: Institutional arrangements of Annex I Parties

Party	Reporting agency *Lead agency for national GHG inventory	Lead LULUCF	Associated agencies	Type of agencies
Australia	Department of Climate Change and Energy Efficiency (DCCEE)	Land Management Branch of the DCCEE	<ul style="list-style-type: none"> - Geosciences Australia - Australian Bureau of Agriculture and Resource Economics - Department of the Environment, Water, Heritage and the Arts - Australian Bureau of Meteorology - Bureau of Rural Sciences - Commonwealth Scientific and Industrial Research Organization - Australian National University - University of Western Australia 	7 <i>Government agency</i> 1 <i>Research organization</i> 2 <i>Universities</i>
Austria	Federal Ministry of Agriculture, Forestry, Environment and Water Management (BMLFUW) *Umweltbundesamt	Umweltbundesamt GmbH (Private company established by government)	<ul style="list-style-type: none"> - Research Centre for Forest - Austrian Federal Office 	3 <i>Government agencies</i> 1 <i>Research institute</i> 1 <i>Consultancy firm</i>
Belarus	Ministry of Natural Resources and Environment Protection *Belarussian Research Center "Ecology"	NA		NA
Belgium	The National Climate Commission *The Interregional Cell for the Environment (IRCEL/CELINE)	IRCEL/CELINE	<ul style="list-style-type: none"> - National Institute of Statistics - Gembloux University 	2 <i>Government agency</i> 1 <i>Research institute</i> 1 <i>University</i>
Bulgaria	Ministry of the Environment *Executive Environment Agency (ExEA)	Land Monitoring Biodiversity and Protected Areas under the ExEA	<ul style="list-style-type: none"> - University of Forest - State Forestry Agency - Consultant 	3 <i>Government agencies</i> 1 <i>University</i> 1 <i>Consultancy firm</i>
Canada	Greenhouse Gas Division of Environment Canada	Agri-Food Canada	<ul style="list-style-type: none"> - Natural Resources Canada - Environment Canada 	4 <i>Government agencies</i>
Croatia	Ministry of Environmental Protection, Physical Planning and Construction *Energy Research and Environmental Protection Institute (EKONERG)	EKONERG	<ul style="list-style-type: none"> - Ministry of Regional Development, Forestry and Water Management - Hrvatskesume public company 	1 <i>Government agency</i> 1 <i>Public company</i> 1 <i>Research institute</i>
Czech Republic	Ministry of Environment *Czech Hydrometeorological Institute	Institute of Forest Ecosystem Research	<ul style="list-style-type: none"> - Czech Office for Surveying, Mapping and Cadastre 	2 <i>Government agencies</i> 2 <i>Research institutes</i>
Denmark	Ministry of Environment *National Environmental Research Institute (NERI)	University of Copenhagen	<ul style="list-style-type: none"> - Danish Forest and Nature Agency, Ministry of Environment - Statistics Denmark - Ministry of Climate and Energy 	3 <i>Government agencies</i> 1 <i>University</i> 1 <i>Research institute</i>
Estonia	Ministry of Environment * Estonian Environment Information Centre (EEIC)	Tallinn University of Technology	<ul style="list-style-type: none"> - Centre of Forest Protection and Silviculture - Estonian Land Board - Statistical Office of Estonia 	4 <i>Government agencies</i> 1 <i>University</i> 1 <i>Research institute</i>

Party	Reporting agency *Lead agency of national GHG inventory	Lead agency of LULUCF sector	Associated agencies	Type of agencies
EU	Directorate-General Climate Action of the European Commission (DG Climate Action)	NA	NA	NA
Finland	Statistics Finland	Finnish Forest Research Institute	- Ministry of the Interior - Geological Survey of Finland - Agrifood Research Finland - University of Helsinki	3 Government agencies 2 <i>Research institutes</i> 1 University
France	*Centre Interprofessionnel Technique d'Etudes de la Pollution Atmosphérique (CITEPA)	NA	- Inventaire Forestier National - Ministry of Agriculture	2 Government agencies 1 Research institute
Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) *Federal Environment Agency (UBA)	Federal Ministry of Food, Agriculture and Consumer Protection (BMELV) and Johann Heinrich Von Thunen Institute (vTI)	- vTI's Institute of Agricultural Climate Research - vTI's Institute of Forest Ecology and Forest Inventory	3 Government agencies 2 <i>Research institutes</i>
Greece	Ministry of Environment, Energy and Climate Change (MEECC) *National Technical University of Athens (NTUA)	NA	- General Directorate of Forest Development and Protection and Natural Resources - General Directorate for the Development and Protection of Forests and Natural Environment - National Statistical Service	4 Government agencies 1 University
Hungary	Ministry for Environment and Water (KVVM) *Greenhouse Gas Inventory Division of the Hungarian Meteorological Service (OMSZ GHG Division)	Central Agricultural Office Forest Directorate	- Forest Research Institute	3 <i>Government agencies</i> 1 Research institute
Iceland	Environment Agency (EA)	Agricultural University of Iceland	- Soil Conservation Service of Iceland - Iceland Forest Service	3 Government agencies 1 <i>University</i>
Ireland	Environmental Protection Agency (EPA) *Agency's Office of Climate, Licensing and Resource Use (OCLR)	Council for Forest Research and Development	- Forest Services - Coillte	3 Government agencies 1 <i>Research institute</i> 1 Consultancy firm
Italy	Ministry for the Environment, Land and Sea *Institute for Environmental Protection and Research (ISPRA)	NA	- Ministry of Agriculture and Forests - Experimental Institute for Forest Management	2 Government agencies 2 <i>Research institutes</i>

Party	Reporting agency *Lead agency of national GHG inventory	Lead agency of LULUCF sector	Associated agencies	Type of agencies
Japan	Ministry of Foreign Affairs/ Ministry of Environment *Greenhouse Gas Inventory Office of Japan (GIO) of the Center for Global Environment Research (CGER) National Institute for Environmental Studies	NA	NA	NA
Latvia	Ministry of Environment *Latvian Environment, Geology and Meteorology Centre (LEGMC)	Latvian State Forest Research Institute "Silava"	- State forest service - Ministry of Agriculture - Central Statistical Bureau - State Firefighting & Rescue Service	6 Government agencies 1 Research institute
Liechtenstein	Office of Environmental Protection	NA	NA	NA
Lithuania	Ministry of Environment *Climate Change Division of the Environmental Quality Department	NA	- Statistics Department of Lithuania - Forest Survey Service - Forest Research Institute	4 Government agencies 1 Research institute
Luxembourg	Ministry of Sustainable Development and Infrastructures *Environment Agency (AEV)	NA	NA	NA
Monaco	In French			
Netherlands	Ministry of Housing, Spatial Planning and the Environment (VROM) *SenterNovem (NL Agency)	NA	- Statistics Netherlands - Wageningen University and research center	3 Government agencies 1 University
New Zealand	Ministry of Environment (MFE)	NA	- MFE - Ministry of Agriculture and Forestry	2 Government agencies
Norway	Climate and Pollution Agency (CPA) *Statistics Norway (SSB)	Norwegian Forest and Landscape Institute (NFLI)	- Norwegian Agricultural Authority - SSB	3 Government agencies 1 Research institute
Poland	Ministry of Environment *Emission Balancing and Reporting Unit of the National Center for Emissions Management (KOBIZE)	NA	- Forest Management and Geodesy Bureau - State Forests	4 Government agencies
Portugal	Ministry for the Environment and Land Use Planning * Portuguese Environmental Agency	NA	- Ecoprogrosso - National Authority for Forest	3 Government agencies 1 Consultancy firm
Romania	Ministry of Environment and Forest *National Environmental Protection Agency (NEPA)	NA	- National Institute for Statistics - Ministry of Agriculture, Forests and Rural Development - National Forest Administration	5 Government agencies

Party	Reporting agency *Lead agency of national GHG inventory	Lead agency of LULUCF sector	Associated agencies	Type of agencies
Russia	In Russian			
Slovakia	Ministry of Environment *The Slovak Hydrometeorological Institute (SHMÚ)	NA	- National Forest Centre in Zvolen - Ministry of Agriculture	3 Government agencies 1 Research institute
Slovenia	Ministry of Environment and Spatial Planning *Environmental Agency	Slovenian Forestry Institute	- Slovenian Agriculture Institute	2 Government agencies 2 <i>Research institutes</i>
Spain	Directorate-General for Environmental Quality and Assessment (DGCEA) at the Ministry for the Environment, Rural and Marine Affairs (MARM)	Land Use and Climate Change Working Party	- Directorate-General (DG) for Sustainable Development of the Rural Environment - DG for Farming and Husbandry Resources - DG for the Natural Environment and Forest Policy - Spanish Office for Climate Change - DG of Environmental Quality and Assessment - Ministry of Public Works - Tecnologías y Servicios Agrarios, S.A.	8 Government agencies 1 Consultancy firm
Sweden	Ministry of Environment *Environmental Protection Agency (EPA)	NA	- EPA - Statistics Sweden - National Board of Forestry - Swedish Meteorological and Hydrological Institute - Swedish Board of Agriculture - Swedish University of Agricultural Sciences	6 Government agencies 1 University
Switzerland	Federal Office for the Environment (FOEN) of Federal Department of the Environment, Transport, Energy and Communications (DETEC)	FOEN	- Swiss Statistical Office of Deforestation - Swiss Federal Institute for Forest, Snow and Landscape Research - Agroscope Reckenholz-Tänikon Research Station - Swiss Federal Statistical Office - Meteotest - Sigmaplan	3 <i>Government agencies</i> 2 <i>Research institutes</i> 2 <i>Consultancy firms</i>
Turkey	Turkish Statistical Institute (TurkStat)	NA	NA	NA
Ukraine	In Russian			
UK	Department of Energy and Climate Change (DECC) *AEA Technology plc. (AEA)	Centre for Ecology and Hydrology	- North Wyke Research	1 Government agency 2 <i>Research institutes</i> 1 <i>Consultancy firm</i>
USA	U.S. Department of State *Environmental Protection Agency	NA	- U.S. Department of Agriculture - Multi-Resolution Land Characteristics	4 Government agencies

Abbreviations:

NA- Relevant information is not available implies that the practice is not performed or performed but is not reported

Appendix 3: Procedural arrangements of Annex I Parties

Party	Key category analysis	Methodology *EF	QA/QC	Inventory management
Australia	T1	T3 *CS	External review: 2 nd party QC: T1, 2 Standard: NA	Software: Management system: - Online Comprehensive Reporting tool - Australian Greenhouse Emission Information System - National Carbon Accounting System (for LULUCF) In conjunction with: QC/QC, calculation, data collection, remote sensing, reporting, automatic data transfer to CRF reporter Archiving: AGEIS database
Austria	T1	T1, 3 *D, CS	External review: 2 nd and 3 rd party QC: T1, 2 Standard: ISO 17020	Software: NA Archiving: Central network server
Belarus		In Russian		
Belgium	T1	NS	External review: 2 nd party QC: T1 Standard: NA	Software: NA Archiving: National database
Bulgaria	T1	T1 *CS	External review: 2 nd and 3 rd party QC: T1, 2 Standard: NA	Software: NA Archiving: Archiving at ExEA
Canada	T1	T1, 2, 3 *CS	External review: 2 nd and 3 rd party QC: T1, 2 Standard: NA	Software: Online database for National Pollutant Release Inventory In conjunction with: NA Archiving: Yes
Croatia	T1	T1 *D	External review: 2 nd party QC: T1 Standard: ISO 9001 and 14001	Software: NA Archiving: Central archive at Croatian Environment Agency
Czech Republic	T1	T1, 2 *D, CS	External review: NS QC: NS Standard: ISO 9001	Software: NA Archiving: Central archiving
Denmark	T1, 2	D, CS, T1 *D, CS, Oth	External review: 3 rd party QC: T1 Standard: ISO 9000	Software: - CollectER - NERIRep - Importer2CRF In conjunction with: Calculation, QA/QC, automatic data transfer to CRF reporter Archiving: Central database at National Environmental Research Institute
Estonia	T2	T1 *D	External review: 2 nd , 3 rd party and public QC: NS Standard: NA	Software: NA Archiving: Central archive at Estonian Environment Information Centre and expert organizations

Party	Key category analysis	Methodology *EF	QA/QC	Inventory management
EU	T1	D, T1, 2, 3 *D, CS	External review: 2 nd party, public QC: NS Standard: ISO 1720	Software: CollectER In conjunction with: Automatic data transfer to CRF reporter Archiving: Inventory databases at EEA- ETC/ACC.
Finland	T2	D, T1, 2, 3 *D, CS	External review: 3 rd party QC: NS Standard: NA	Software: NA Archiving: Main archives are at Statistics Finland and additional archives at expert organizations
France	T1	CR, CS, T2 *D, CS	External review: 3 rd party, public QC: NS Standard: ISO 9001: 2000	NA
Germany	T1	D, CS, T2 *NA	External review: 2 nd and 3 rd party QC: T1, 2 Standard: NA	Software: Central System of Emission (CSE) In conjunction with: QA/QC at data level, calculation, recalculation, automatic data transfer to CRF reporter Archiving: Integrated national database at the Federal Environment Agency
Greece	T1	D, CS, T1, 2 *D, CS	External review: 3 rd party and public QC: NS Standard: ISO 9001	Software: NA Archiving: Centralized inventory files at Ministry of Environment, Energy and Climate Change
Hungary	T1	T1, 2 *D, CS	External review: NA. Plan for 2 peer-reviews in 2010 QC: T1 Standard: ISO 9001	Software: NA Archiving: Research Institute for Soil Science and Agricultural Chemistry of the Hungarian Academy of Sciences and Central Agricultural Office Forest Directorate
Iceland	T1	T1, 2, 3 *D, CS	External review: 2 nd and 3 rd party QC: T1 Standard: ISO 9001: 2000	Software: NA Archiving: NA
Ireland	T1, 2	D, T1, 2, 3 *D, CS	External review: NS QC: NS Standard: NA	Software: NA Archiving: NA
Italy	T1, 2	T1, 2 *D, CS, Oth	External review: NA. Not implemented yet. QC: T1 Standard: NA	Software: NA Archiving: Database at the National Institute of Statistics
Japan	T1, 2	T2, 3 *D	External review: 2 nd and 3 rd party QC: T1 Standard: NA	Software: NA Archiving: At Center for Global Environment Research server
Latvia	T1	T1, 2 *D	External review: 3 rd party and public QC: T1 Standard: NA	Software: Integrated statistical data management system (ISDMS), with online data collection function In conjunction with: QA/QC Archiving: at Latvian Environment, Geology and Meteorology Centre and expert organizations
Liechtenstein	T1	T2, Oth (swiss) *CS	External review: NA QC: NA Standard: NA	Software: NA Archiving: Central network

Party	Key category analysis	Methodology *EF	QA/QC	Inventory management
Lithuania	T1	D, T1 *D, CS	External review: NA QC: T1 Standard: NA	Software: NA Archiving: Ministry of Environment
Luxembourg	NS	CS *NA	External review: 3 rd party (Bilateral cooperation) QC: T1, 2 Standard: NA	Software: CIRCALUX centralized data management and archiving system In conjunction with: NA Archiving: Centralized archiving system
Monaco	T1	T1 *NA	External review: NA QC: T1 Standard: NA	Software: NA Archiving: Centralized system at Direction de l'Environnement
Netherlands	T1, 2	D, CS, T2 *CS, Oth	External review: 2 nd , 3 rd party and public QC: T1 Standard: European Foundation for Quality Management Business Model	Software: NS In conjunction with: Automatic data transfer to CRF reporter Archiving: Centralized system at Netherlands Environmental Assessment Agency database
New Zealand	T1	T1, 2 *D, CS	External review: 3 rd party QC: T1 Standard: NA	Software: LCAS Data management system (for LULUCF) In conjunction with: Geospatial system, calculation, reporting application Archiving: Central computer network of Ministry of Environment
Norway	T1, 2	T1, 2, 3 *D, CS	External review: NS QC: NS Standard: NA	Software: SAS system software and Fortran (for LULUCF) In conjunction with: Calculation, reporting application Archiving: Archived at NFLI
Poland	T1	T1, 2 *D, CS	External review: NS QC: NS Standard: NA	Software: NA Archiving: NEC database
Portugal	T2	D, CS, T2 *NA	External review: NS QC: T1, 2 Standard: NA	Software: NA Archiving: Yes
Romania	T1	T1, 2 *D, CS	External review: 3 rd party (Bilateral cooperation) QC: T1 Standard: NA	Software: NA Archiving: Single location at National Environment Protection Agency
Russia		In Russian		
Slovakia	T1	T2, CS *D, CS	External review: 2 nd , 3 rd party and public QC: T2 Standard: ISO 9001: 2008	Software: NA Archiving: Central archiving at SHMÚ
Slovenia	T1, 2	T1, 2, 3 *D, CS	External review: NA QC: T1 Standard: NA	Software: Emission Inventory Information System (ISEE) In conjunction with: QA/QC, calculation Archiving: Joint database (Oracle database)

Party	Key category analysis	Methodology *EF	QA/QC	Inventory management
Spain	T1, 2	CS *D, CS	External review: 3 rd party, bilateral cooperation QC: T1 Standard: NA	Software: Oracle database In conjunction with: Calculation Archiving: Oracle database
Sweden	T1	CS, T1, 3 *CS	External review: 2 nd party QC: T1 Standard: NA	Software: TPS In conjunction with: Calculation, automatic data transfer to CRF reporter Archiving: Central database - TPS
Switzerland	T1, 2	T1 *D	External review: NA. Bilateral cooperation for 2011 submission. QC: T2 Standard: ISO 9001: 2000	Software: Swiss National Air Pollution Database (EMIS) In conjunction with: Calculation, automatic data transfer to CRF reporter Archiving: Central database at FOEN – EMIS database
Turkey	NS	NA	NA	NA
Ukraine		In Russian		
UK	NS	D, CS, T1, 2, 3 *CS	External review: 3 rd party (Bilateral cooperation) QC: NS Standard: ISO 9001: 2008	Software: National Atmospheric Emissions Inventory (NAEI) In conjunction with: Calculation Archiving: NAEI database
USA	T1, 2	T1, 2, 3 *D, CS	External review: 3 rd party and public review QC: T1, 2 Standard: NA	Software: NA Archiving: Central server at EPA

Abbreviations:

NS- The practice is performed but not clearly specified

NA- Relevant information is not available implies that the practice is not performed or performed but is not reported

D- IPCC Default, T1- IPCC Tier 1, T2- IPCC Tier 2, T3- IPCC Tier 3, CS- Country specific, CR- CORINAIR methodology, Oth refers to other methodologies, e.g. from neighboring countries and regional values

Appendix 4: Legal arrangements of non-Annex I Parties

Party	Mandate for national GHG inventory	Mandate for LULUCF sector	Legal instruments for data collection	Other legal instruments
Argentina	In Spanish			
Bangladesh	Yes	NA	No mandate for NFI	NA
Bhutan	NA	NA	NA	NA
Bolivia	NA	NA	NA	NA
Botswana	No	NA	No mandate for NFI	NA
Burundi	Yes	NA	No mandate for NFI	NA
Cambodia	NA	NA	NA	NA
Costa Rica	Yes	NA	No mandate for NFI	NA
Colombia	NA	NA	NA	NA
Democratic republic of Congo	NA	NA	NA	NA
Ecuador	In Spanish			
Equatorial Guinea	Yes	NA	No mandate for NFI	NA
Gabon	Yes	NA	Mandate for NFI	NA
Guatemala	In Spanish			
Guyana	No	NA	NA	NA
Indonesia	NA	NA	NA	NA
Kenya	NA	NA	NA	NA
Malawi	No	Employ consultancy firm	Mandate for NFI	NA
Mexico	In Spanish			
Nepal	NA	NA	Mandate for NFI	NA
Panama	In Spanish			
Papua New Guinea	NA	NA	NA	NA
Paraguay	NA	NA	NA	NA
Philippines	No	NA	NA	NA
Solomon Islands	NA	NA	NA	NA
South Africa	Yes	Employ consultancy firm	No mandate for NFI	NA
Sri Lanka	Yes	Employ consultancy firm	No mandate for NFI	NA
Sudan	No	NA	Mandate for NFI	NA
Tanzania	NA	NA	NA	NA
Vietnam	NA	NA	NA	NA
Zambia	Submitted but not available on UNFCCC website			

Appendix 5: Institutional arrangements of non-Annex I Parties

Party	Reporting agency *Lead agency for the national GHG inventory	Lead agency of the LULUCF sector	Associated agencies	Type of agencies
Argentina	In Spanish			
Bangladesh	Ministry of Environment and Forest (MoEF) *NS	NA	- Bangladesh Forest Department of the MoEF	2 Government agencies
Bhutan	*National Environment Commission (NEC)	Department of Forestry Service	- Ministry of Agriculture	3 Government agencies
Bolivia	NA	NA	- Forest Superintendent the Legal Affairs Ministry - Courts for forest law enforcement - Forestry Directorate	3 Government agencies
Botswana	Department of Meteorological Services (DMS) under the Ministry of Environment, Wildlife and Tourism *University of Botswana	NA	NA	NA
Burundi	Department of Environment *Department of Forest	NS	NA	NA
Cambodia	Ministry of Environment *National Technical Committee	Department of Forestry and Wildlife, Ministry of Agriculture, Forestry and Fisheries	NA	3 Government agencies
Central African Republic	NA	NA	NA	
Costa Rica	*National Meteorological Institute	- Ministry of Agriculture - Information Department of the National Meteorological Institute	- Climatology Department, National Meteorological Institute	3 Government agencies
Colombia	NA	NA	- Hydrology, Meteorology and Environmental Studies Institute - National Environmental Information System Research Institutes	2 Research institutes
Democratic republic of Congo	NA	NA	- Department for Permanent Service for Forest Inventory and Management	1 Government agency
Ecuador	In Spanish		- Ministry of Environment	1 Government agency
Equatorial Guinea	*Ministerio de Pesca y Medio Ambiente	NA	NA	NA

Party	Reporting agency * Lead agency for the national GHG inventory	Lead agency of LULUCF sector	Associated agencies	Type of agencies
Gabon	NS	- Agriculture General Direction - Environment General Direction - Forestry and Water Affairs	- Ministry of Forest and Water Affairs (Forest General Direction)	4 Government agencies
Guatemala	NA	NA	NA	NA
Guyana	NA	NA	NA	NA
Indonesia	*Ministry for Environment	NA	NA	NA
Kenya	NA	NA	- Kenya Forest Service	1 Government agency
Malawi	Environmental Affairs *Consultancy firm	Consultancy firm	NA	1 Government agency 1 Consultancy firm
Mexico	In Spanish	NA	- National Forestry Commission of Mexico	1 Government agency
Nepal	Central Department of Hydrology and Meteorology and Tribhuvan University	NA	- Ministry of Forests and Soil Conservation	2 Government agencies 1 University
Panama	In Spanish		- Autoridad Nacional del Ambiente	1 Government agency
Papua New Guinea	NA	NA	- Department of Environment and Conservation - Forest Authority - Forestry Research Institute	2 Government agencies 1 Research institute
Paraguay	NA	NA	NA	NA
Philippines	NA	NA	NA	NA
Solomon Islands	NA	NA	NA	NA
South Africa	*Atmospheric Quality Information (AQI) unit within Department of Environmental Affairs (DEA)	Consultancy firm	NA	1 Government agency 1 Consultancy firm
Sri Lanka	Climate Change Secretariat *Consultancy firm	Consultancy firm	NA	1 Government agency 1 Consultancy firm
Sudan	*Higher Council of Environment and Natural Resources	University of Khartoum, Faculty of Forestry	- Forest National Corporation	2 Government agencies 1 University

Party	Reporting agency * Lead agency for the national GHG inventory	Lead agency of LULUCF sector	Associated agencies	Type of agencies
Tanzania	*Centre for Energy, Environment, Science and Technology (CEEST)	CEEST	NA	1 <i>Research institute</i>
Vietnam	*Ministry of Natural Resources and Environment (MoNRE)	Ministry of Agriculture and Rural Development (MARD)	NA	2 <i>Government agencies</i>
Zambia	Not available on UNFCCC website			

Abbreviations:

NA- Relevant information is not available implies that the practice is not performed or performed but is not reported

NS- Relevant information is available but not clearly specify

Appendix 6: Procedural arrangements of non-Annex I Parties

Party	Key category analysis	Methodology *EF	QA/QC	Inventory management
Argentina	In Spanish			NA
Bangladesh	NA	NA *D	NA	NA
Bhutan	NA	NA	NA	NA
Bolivia	T1	NA	QC: Yes	NA
Botswana	NA	NA	NA	Software: No special software Archiving: Yes. Hard copy
Burundi	NA	NA	NA	NA
Cambodia	NA	NA *D, CS	NA	NA
Central African Republic	NA	NA	NA	NA
Costa Rica	Yes. Quantitative T1	NA	NA	Software: UNFCCC CRF reporter, Excel. No special software Archiving: Yes. Electronic and hard copy
Colombia	NA	NA	NA	NA
Democratic republic of Congo	NA	NA	NA	NA
Ecuador	In Spanish	NA	NA	NA
Equatorial Guinea	Not perform	NA	NA	Software: No special software Archiving: No
Gabon	Yes. Qualitative and quantitative T1	NA	NA	Software: UNFCCC CRF reporter, Excel. No special software Archiving: Yes. Electronic and hard copy
Guatemala	NA	NA *D	NA	NA
Guyana	NA	T1 *D	NA	NA
Indonesia	NA	NA *D	NA	NA
Kenya	NA	NA	NA	NA
Malawi	Not perform	NA	NA	Software: UNFCCC. No special software Archiving: Yes. Electronic and hard copy
Mexico	NA	NA *T1	NA	NA
Nepal	Not perform	NA *D	NA	Software: No special software Archiving: Yes. Electronic and hard copy
Panama	In Spanish		NA	NA

Party	Key category analysis	Methodology *EF	QA/QC	Inventory management
Papua New Guinea	NA	NA *D	NA	NA
Paraguay	NA	NA	NA	NA
Philippines	NA	NA	NA	NA
Solomon Islands	Expert judgment	NA	NA	NA
South Africa	T1	NA	NA	Software: No special software Archiving: Yes. Electronic and hard copy
Sri Lanka	Not perform	NA *D	NA	Software: Excel tables. No special software Archiving: Yes. Electronic and hard copy
Sudan	Not perform	NA *D	NA	Software: UNFCCC 2005. No special software Archiving: Yes
Tanzania	NA	NA *D	QA/QC: Yes	NA
Vietnam	T1	NA	NA	NA
Zambia	Not available for download from UNFCCC website			

Abbreviations:

NA- Relevant information is not available implies that the practice is not performed or performed but is not reported

D- IPCC Default, T1- IPCC Tier 1, T2- IPCC Tier 2, T3- IPCC Tier 3, CS- Country specific

