CANADA'S INITIAL REPORT UNDER THE KYOTO PROTOCOL

Facilitating the calculation of Canada's assigned amount and demonstrating its capacity to account for its emissions and assigned amount under the Kyoto Protocol, pursuant to Article 7, paragraph 4 of the Kyoto Protocol

Government of Canada Gouvernement du Canada

Canada

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Summary

The *Initial Report* demonstrates that Canada has implemented the requirements for accounting for its emissions under the Kyoto Protocol and is taking the necessary steps to develop its capacity to account for assigned amount units via its national registry. The report is prepared pursuant to the requirements specified in Decision 13/CMP.1 (Modalities for the accounting of assigned amount under Article 7, paragraph 4 of the Kyoto Protocol).

The report contains information to facilitate participation in the Kyoto Protocol, including a number of technical definitions, descriptions, calculations and decisions. These may be summarized as:

- **Complete inventories** of anthropogenic emissions by source and removals by sinks of greenhouse gases not controlled by the Montreal Protocol for 1990 – 2004

- Identification of **1990** as Canada's selected base year for hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride

- Calculation of Canada's **assigned amount** as: **2,814,882,729 tonnes** carbon dioxide equivalent (CO_2-eq.)

- Calculation of Canada's **commitment period reserve** as: **2,533,394,456** CO_2-eq.

- Canada's decision to **account** for cropland management under Article 3.4 during the first commitment period

- Identification of Canada's **single minimum values** for use in accounting for its activities under Article 3.3 and Article 3.4:
    - tree crown cover: **25 percent**
    - minimum land area: **1 hectare**
    - tree height: **5 metres**

- Canada's intention to use **entire commitment period accounting** for all activities under Article 3.3 and Article 3.4 during the first commitment period

- A description of Canada's **national system** in accordance with Article 5, paragraph 1 and Decision 19/CMP.1 detailing the legal, institutional and procedural arrangements established for the continued compilation of Canada's greenhouse gas inventory

- A short description of Canada's actions vis-à-vis the **national registry** in accordance with Article 7 and Decision 15/CMP.1

1. Introduction

At the first Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol (CMP.1), the Parties reconfirmed that Annex I Parties that have ratified the Kyoto Protocol are required to submit an *Initial Report* prior to 1 January 2007, or within one year of entry into force of the Kyoto Protocol for the Party, whichever is the later date (decision 13/CMP.1).

According to requirements contained in the Annex to Decision 13/CMP.1 (*Modalities for the accounting of assigned amounts under Article 7, paragraph 4 of the Kyoto Protocol*), the "Initial Report" is to contain the following information:

Part One:

a) Complete inventories of anthropogenic emissions by sources and removals by sinks of greenhouse gases not controlled by the Montreal Protocol for all years from 1990, or another approved base year or period under Article 3, paragraph 5, to the most recent year available. Inventories should be prepared in accordance with Article 5, paragraph 2, and relevant decisions of the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol (CMP.1), taking into account any relevant decisions of the Conference of the Parties.

b) Identification of the selected base year for hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) in accordance with Article 3, paragraph 8. Parties may choose 1990 or 1995 as the base year for HFCs, PFCs and SF_6.

c) The agreement under Article 4, where the Party has reached such an agreement to fulfill its commitments under Article 3 jointly with other Parties.

d) Calculation of the Party's assigned amount pursuant to Article 3, paragraphs 7 and 8, on the basis of its inventory of anthropogenic emissions by sources and removals by sinks of greenhouse gases not controlled by the Montreal Protocol.

Part Two:

a) Calculation of its commitment period reserve in accordance with decision 11/CMP.1. The commitment period reserve is 90 percent of the assigned amount or 100 percent of five times its most recently reviewed inventory, whichever is the lowest.

b) Identification of the single minimum values for tree crown cover, land area and tree height for use in accounting for activities under Article 3,

paragraphs 3 and 4, together with a justification of the consistency of those values with the information that has been historically reported to the Food and Agriculture Organization of the United Nations or other international bodies, and in the case of difference, an explanation of why and how such values were chosen, in accordance with decision 16/CMP.1.

c) Identification of its elected activities under Article 3, paragraph 4, for inclusion in its accounting for the first commitment period, together with information on how its national system under Article 5, paragraph 1, will identify land areas associated with the activities, in accordance with decision 16/CMP.1.

d) The identification of whether, for each activity under Article 3, paragraph 3 and Article 3, paragraph 4, the Party intends to account annually or for the entire commitment period.

e) A description of the Party's national system in accordance with Article 5, paragraph 1, reported in accordance with the guidelines for the preparation of the information required under Article 7 of the Kyoto Protocol.

f) A description of the Party's national registry, reported in accordance with the guidelines for the preparation of the information required under Article 7 of the Kyoto Protocol.

Part One

2. Calculation of Canada's assigned amount

2.1 Complete inventories of anthropogenic emissions by sources and removals by sinks of GHG for all years from 1990 to the most recent year available

Canada submitted its latest national inventory, covering the period 1990-2004, to the UNFCCC on May 11, 2006. In electronic format, together the National Inventory Report (NIR) and the Common Reporting Format (CRF) files in both French and English amount to approximately 20 Mb in size, and as such, are not appended to this report. The final edited and published version of the NIR[1] and the accompanying CRF Tables were re-submitted in hard copy, as well as on CD-ROM to the UNFCCC Secretariat in December 2006. The final version of the national inventory is identical to that submitted in May, with the exception of

[1] Environment Canada - National Inventory Report: 1990-2004, Greenhouse Gas Sources and Sinks in Canada (The Canadian Government's Submission to the UN Framework Convention on Climate Change, April, 2006).

editing and layout changes. The reader should refer to these documents as the official inventory submitted as a companion to this Initial Report.

2.2 Identification of the selected base year for hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6)

Canada has selected **1990** as the base year for emissions of hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride for the purpose of the calculation of its assigned amount under Article 3, paragraph 7.

2.3 Agreement under Article 4

This clause is not applicable to Canada.

2.4 Calculation of Canada's assigned amount

The national GHG inventory covering the period 1990-2004, submitted in May 2006 to the UNFCCC as referred to in Section 2.1, is used as the basis for this calculation. In accordance with Article 3, paragraphs 7 and 8 of the Protocol, Canada's assigned amount for the period 2008-2012 is equal to the percentage inscribed for it in Annex B of the Protocol (i.e. 94 percent) of its aggregate anthropogenic carbon dioxide equivalent (CO_2-eq.) emissions of the greenhouse gases listed in Annex A in 1990 (the base year), multiplied by five.

The provisions as found in the second sentence of Article 3, paragraph 7 do not apply to Canada because in its latest submitted inventory the Land Use, Land-Use Change and Forestry sector (CRF sector 5) in 1990 represented net removals of about 82 M tonnes and therefore was not a net source of emissions.

Canada's Assigned Amount = 0.94 x 598,911,219 tonnes CO_2-eq. x 5 = **2,814,882,729 tonnes CO_2 eq. (2,814,882,729 assigned amount units)**

Part Two

3. Calculation of Canada's commitment period reserve

In accordance with decision 11/CMP.1, the commitment period reserve is either 90 percent of a Party's assigned amount *or* 100 percent of five times its most recently reviewed inventory.

Therefore Canada's commitment period reserve is calculated as:

Either
a) 90% of Canada's assigned amount from Section 2.4 above

= 0.9 x 2,814,882,729 tonnes CO_2-eq.

= 2,533,394,456 tonnes CO_2-eq.

or

b) 100% of 5 x Canada's most recently reviewed inventory (2003)

= 5 x 740,214,485 tonnes CO_2-eq.

= 3,701,072,424 tonnes CO_2-eq.

The lower of the two numbers in a) and b) above is that calculated as 90% of Canada's assigned amount in a).

Therefore, Canada's Commitment Period Reserve is **2,533,394,456 tonnes CO_2-eq. (or 2,533,394,456 assigned amount units).**

4. Land use, land-use change and forestry (LULUCF)

4.1 Identification of the single minimum values for tree crown cover, land area and tree height for use in the accounting for activities under Article 3, paragraphs 3 and 4

4.1.1 Parameters for definition of forest

For the purposes of applying the definition of "forest" as contained in paragraph 1(a) of the Annex to Decision 16/CMP.1, for use in accounting for its activities under Article 3, paragraphs 3 and 4, Canada selects the following single minimum values:

Minimum tree crown cover = 25 percent
Minimum land area = 1 hectare
Minimum tree height = 5 metres

In addition, as recommended in Chapter 4 of IPCC Good Practice Guidance for Land Use, Land-Use Change and Forestry, Canada has identified a minimum width of 20 metres (distance between trunks) as a definitional criterion to specify the shape of the forests.

4.1.2 Justification of consistency with historically reported values

These values differ from the information that has historically been reported to the Food and Agriculture Organization (FAO) of the United Nations. Canada's National Forest Inventory 2001 (CanFI2001) has been the basis for Canada's reporting to FAO. CanFI2001 is a compilation of different data sources into a common format. The 56 source inventories for CanFI2001 apply a range of approaches to determine polygon size and crown cover and hence there is no single forest definition that underlies Canada's reporting to FAO.

A minimum crown cover of 25 per cent, or equivalent stocking level, is similar to the standards used by most of Canada's provinces and territories. The minimum forest area or polygon size used in forest inventories for CanFI2001 varies by jurisdiction from 0.5 to 5 hectares. CanFI2001 does not contain tree height information. It does, however, contain information about site productivity (e.g. >5 metres at age 50), which is used by many jurisdictions in classifying their forests.

A new National Forest Inventory is being established and, in the future, should allow greater consistency in the minimum values for Canada's forest definition reported to FAO and under the Kyoto Protocol.

4.2 Election of activities under Article 3.4

In accordance with Decision 13/CMP.1 Annex paragraph 8(c), Canada has elected to account for Cropland Management under Article 3, paragraph 4 during the first commitment period.

4.3 Accounting under Article 3.3 and 3.4

In accordance with Decision 13/CMP.1 Annex paragraph 8(d), for each activity under Article 3, paragraph 3 and elected under Article 3, paragraph 4, Canada intends to account for the entire commitment period.

5. Description of Canada's national system according to guidelines under Article 5, paragraph 1

5.1 Introduction

Under Article 5, paragraph 1 of the Kyoto Protocol, each Party to the Kyoto Protocol included in Annex I shall have in place, no later than 1 January, 2007, a national system for the estimation of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montréal Protocol. The National Inventory System encompasses the institutional, legal and procedural arrangements necessary to ensure that Parties meet their reporting obligations, that quality inventories are prepared, and that proper documentation and archiving occur in order to facilitate third party review and to assess compliance with Kyoto Protocol targets.

This section contains a description of the state of development of Canada's National System. The information is presented to the extent possible in accordance with the guidelines under Article 7, paragraph 2 (as per the requirements of the guidelines under Article 7, paragraph 4 on the content of the Initial Report) and the guidelines under Article 5, paragraph 1, as found in the Annex to Decision 19/CMP.1. Topics covered are the legal basis for the national system, the roles and responsibilities of the inventory agency and of the various players involved, the process for inventory preparation, quality management, and

the approval of the inventory as well as the preparation for reporting on activities under Article 3, paragraphs 3 and 4.

5.2 Institutional, legal and procedural arrangements

5.2.1 Name and contact for the national entity with responsibility for the national inventory

The national entity responsible for Canada's national inventory system is the Greenhouse Gas Division of Environment Canada.

National Inventory Focal Point: Art Jaques, Director
Greenhouse Gas Division
Science and Risk Assessment Directorate
Science and Technology Branch
Environment Canada
19th floor, 351 St Joseph Boulevard
Gatineau (Quebec) K1A 0H3
Telephone: +1-819-994-3098
Fax: +1-819-953-3006
E-mail: art.jaques@ec.gc.ca

A detailed description of the functions of the Greenhouse Gas Division is provided under Institutional arrangements below.

5.2.2 Legal basis

The provisions of the *Government Organization Act* (1970) establish the powers of the Federal Minister of the Environment and together with the *Department of the Environment Act* (1985), empower the Minister to provide Canadians with information on the environment and provide legislative means to implement environmental agreements.

The *Canadian Environmental Protection Act*, enacted in 1988 and revised in 1999, provides the legislative authority for the Department of the Environment (Environment Canada) to establish the national inventory system and to designate Environment Canada's Greenhouse Gas Division as the single national entity with responsibility for the preparation and submission of the national inventory to the UNFCCC. The Government of Canada made this information available to the UNFCCC Executive Secretary in a letter from the Department of Foreign Affairs and International Trade dated 3 November, 2004.

In addition, in an effort to improve Canada's ability to monitor, report and verify its greenhouse gas emissions, the Government of Canada, in partnership with the provincial and territorial governments, launched in March, 2004 a national

mandatory greenhouse gas reporting system under Section 46 of the *Canadian Environment Protection Act* (1999). This system requires facilities emitting 100,000 tonnes (100 kt) or more of CO_2 equivalent of GHG emissions to annually report by 1 June their emissions from the previous year. While the data from the mandatory system is currently not directly used to calculate the national inventory, it nevertheless provides useful and precise information on the sources and quantities of Canada's GHG emissions, which can be used to improve and confirm emissions estimates developed from national and provincial statistics.

5.2.3 Institutional arrangements

The Kyoto Protocol recognizes the importance of the National System in preparing a quality inventory. To date, the Government of Canada has also recognized this and attaches great importance to the quality of national greenhouse gas (GHG) estimates and is committed to improving our data and methods in collaboration with industry, the provinces and territories, academia and the international community to ensure that we produce a credible and defensible inventory that will stand the test of external review and meet our international obligations.

The assessment of compliance with a Kyoto Protocol target is based on a comparison of a country's inventory of total GHG emissions for the 2008-2012 period with its total holdings of Kyoto units for that same period. The Kyoto Protocol stipulates that Parties shall implement administrative systems to accurately estimate their emissions by sources and removals by sinks as well as track and account for holdings of Kyoto units. Implementing such systems by 1 January, 2007, and reporting information generated by them, is an eligibility requirement for use of the Kyoto Mechanisms. Since the 3rd Conference of the Parties, Canada has allocated significant amounts of funds to support the GHG inventory activities of monitoring, reporting and review to meet the enhanced UNFCCC reporting requirements and to prepare for the more rigorous Kyoto Protocol requirements. The process of developing a National System capable of meeting international obligations supporting domestic climate change strategies and programs, and mechanisms for auditing and verification of emissions has been initiated and is on-going.

The remainder of this section details the roles and responsibilities of the various agencies and players in the National System and shows that Canada has taken a pragmatic approach in implementing its National System. Figure 1 identifies the different partners of the inventory agency and their contribution.

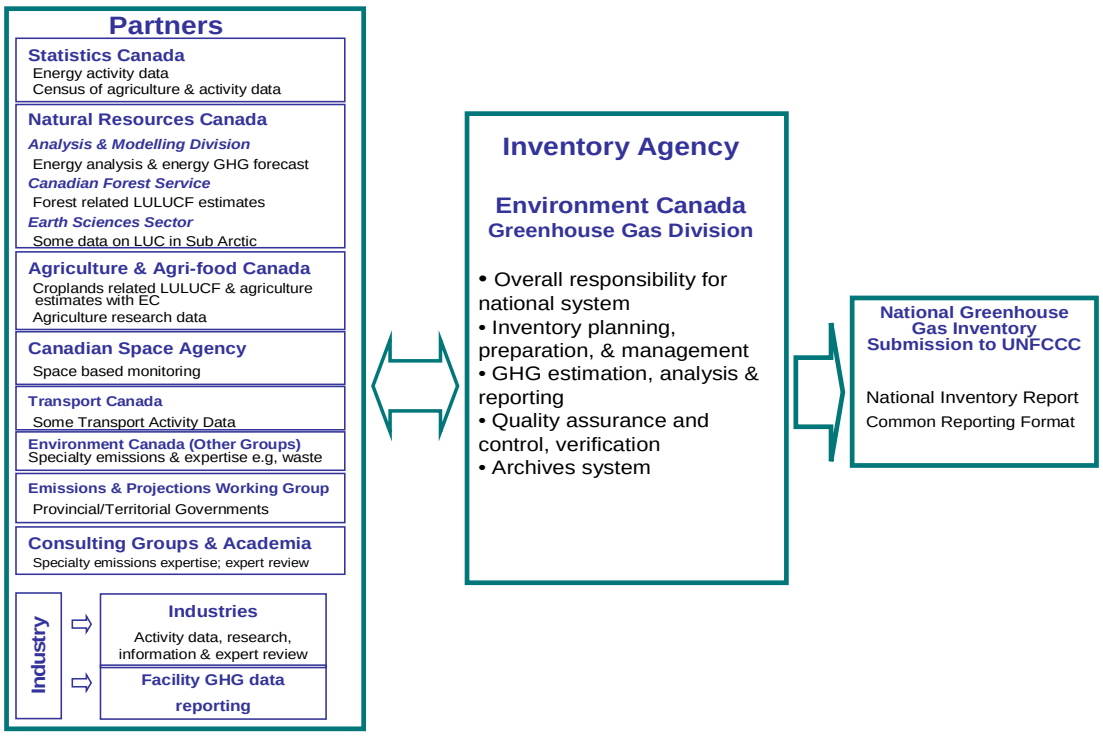

Figure 1: Partners of the National Inventory System

Environment Canada

Environment Canada prepared the first national carbon dioxide inventory in 1989 (published in May 1990) and the first complete GHG inventory in 1990 (published in 1992). Inventories of greenhouse gas sources and sinks were then produced annually. In accordance with the provisions of decision 3/CP.5, since the year 2000 national inventories have been submitted to the UNFCCC by 15 April every year. Over the last decade, the mandate of the Greenhouse Gas Division (GHGD) of Environment Canada (EC) has evolved from a relatively straightforward function with responsibility for monitoring and estimating sources and sinks of greenhouse gases, to one that is responsible for the establishment and maintenance of the National System. This involves inventory planning, preparation and management functions.

The GHGD is composed of qualified engineers and scientists organized in five sections: Energy; Industrial Processes and Waste; Agriculture Forestry and Other Land Uses; Reporting and Quality Management and Verification. Its primary mandate is the national GHG inventory. Inventory experts develop, analyze and verify activity data, methods, emission factors and the emission and removal estimates. The Division produces reports and publishes (including on the Internet) the National Inventory Report and the Common Reporting Format. It manages the quality system, performs trends analysis, publishes fact sheets and acts as a clearinghouse for GHG information and technical guidance on GHG quantification. Moreover, the GHGD manages the national mandatory GHG

reporting program. GHGD's personnel are also involved in the Intergovernmental Panel on Climate Change inventory program on guidelines and Good Practice Guidance development on the Task Force Bureau and as lead authors and editors. Finally, they participate as experts on methodological and reporting issues in the UNFCCC negotiations and as inventory reviewers and lead reviewers in UNFCCC expert review teams, for which they have been duly trained.

Recognizing the need to draw on the best available technical and scientific expertise and information to meet the objectives of the system, the GHGD has defined roles and responsibilities for the preparation of the inventory, both internally and externally. Figure 2 illustrates the core functions within the Greenhouse Gas Division (more information can be found under section 5.3 on inventory preparation process).

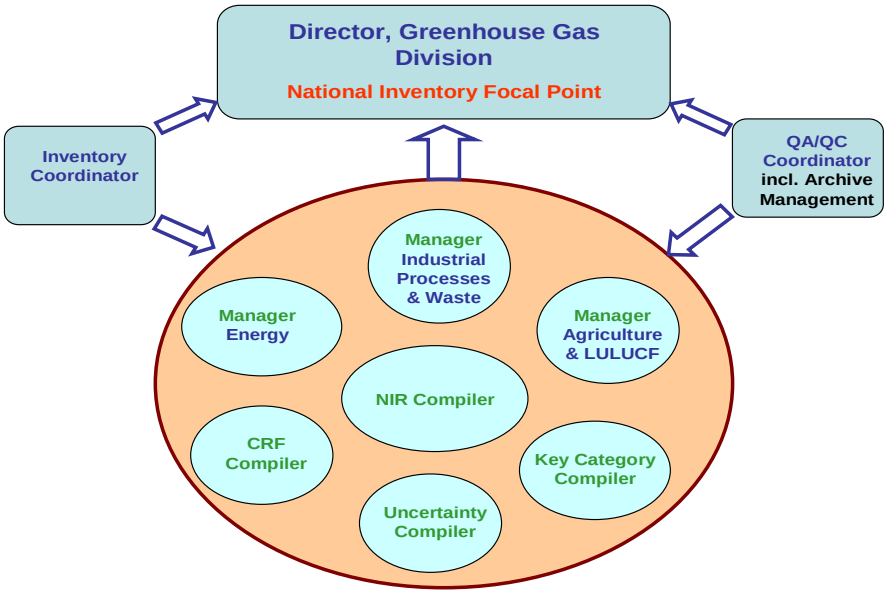

Figure 2: Functions in the Inventory Agency

Because sources and sinks of greenhouse gases originate from a tremendous range of economic sectors and activities, the GHGD is involved in many partnerships with data providers and expert contributors in a variety of ways ranging from informal to formal arrangements. Formal arrangements have been set up with Statistics Canada, Agriculture and Agri-Food Canada and the Canadian Forest Service of Natural Resources Canada, as is explained below. EC has set a goal to formalize some of its partnerships and working relationships, in particular with industry associations, in order to reinforce the capacity, the robustness and the sustainability of the system, as well as its quality.

Groups at Environment Canada other than the GHG Division also contribute data on waste and waste management, residential fuel use of biomass, and emissions of sulphur hexafluoride, ozone and aerosol precursors.

Statistics Canada

Canada's national statistical agency, Statistics Canada, provides Environment Canada with a large portion of the underlying activity data to estimate greenhouse gas emissions for the Energy and the Industrial Processes sector. The *Manufacturing, Construction and Energy Division (MCED)* of Statistics Canada is responsible for the collection, compilation and dissemination of the energy balance in its *'Annual Report on Energy Supply and Demand in Canada' (ARESD)*. It also conducts the annual survey of the *Industrial Consumption of Energy (ICE)*, a bottom-up approach which may be used in the inventory in the future. Both the industrial consumption of energy products and the energy balance are used by various federal departments for energy efficiency programs, policy development, reporting to the International Energy Agency, energy and emissions forecasting and reporting to the UNFCCC. Energy and fossil fuel data are collected by a mix of annual and monthly census and surveys from provincial regulatory agencies (such as the Alberta Energy Utilities Board), from provincial energy departments and from the *Canadian Industrial Energy End Use Data and Analysis Centre (CIEEDAC)*.

The quality objectives of MCED aim at ensuring that the information collected under the authority of the *Statistics Act* and used in the development of the energy balance meets the criteria of completeness, consistency, and accuracy. To assist with its quality control and quality assurance process, MCED has established partnerships with various federal government departments, provincial energy ministries, industrial associations, and centres of excellence. The quality management system for the energy balance includes an internal and external review process. MCED's quality assurance framework and methodological reports are documented and made available through Statistics Canada's Integrated Meta Database.

Internal data quality checks are performed on the information collected through provincial energy departments and from various supply, disposition and consumption surveys.

Due to the complexity of energy data, a *Working Group on Energy Statistics (WGES)* was established to provide advice, direction, and recommendations. The WGES consists of members from Statistics Canada, Environment Canada and Natural Resources Canada and its mandate is to identify and address issues related to the collection of a comprehensive set of energy data for various sectors of the economy and to improve existing energy statistics.

A *'work-in-progress'* review has been established with Environment Canada and Natural Resources Canada to review the industrial consumption of energy products and the energy balance prior to their official release. Canadian industry members also participate in the review of industrial data through the *Canadian Industrial Program for Energy Conservation (CIPEC)* group. CIEEDAC also participates in the review of refinery data and the industrial energy statistics. The national (and provincial) energy balance is transmitted annually to Environment Canada according to the terms of a Memorandum of Understanding between the two departments.

In addition to the energy balance provided by MCED, other groups in Statistics Canada are also responsible for gathering and reporting transport activity data such as vehicle fleet and other non-energy related industrial information, including urea and ammonia production. The statistics agency also collects agriculture activity data through the Agriculture Census, which has taken place every 5 years since 1906, as well as animal population data on an annual or 5 year basis. Furthermore Statistics Canada provides other activity data such as solid waste land disposal and population data.

Finally, Environment Canada has also established a formal agreement (Memorandum of Understanding) with Statistics Canada to act as the collection vehicle for the mandatory reporting program which collects facility-level GHG data.

Natural Resources Canada (NRCan)

NRCan is a key partner of EC who provides energy expertise and analysis; serves as expert reviewer for the energy sector; and collects and provides activity data on mineral production, ethanol consumption and wood residue. The Analysis and Modelling Division of NRCan is responsible for preparing GHG emissions forecasts for the energy sector.

Land Use, Land-Use Change and Forestry Monitoring Accounting and Reporting System (LULUCF MARS)

Since 2004, Environment Canada has officially designated responsibilities to the Canadian Forest Service of Natural Resources Canada (NRCan-CFS) and to Agriculture and Agri-food Canada (AAFC) for the development of key components of the LULUCF sector and has established formal and explicit governance mechanisms to that effect. The national inventory submitted in 2006 was the first one to incorporate estimates developed by these partners. The LULUCF arm of the national system, called the Monitoring, Accounting and Reporting System (MARS) for LULUCF, was designed to develop the necessary inventory estimation and accounting systems, and to coordinate the work of the involved agencies ensuring that Canada meets both UNFCCC-specific and Kyoto Protocol–specific reporting requirements for the LULUCF sector. Canada's

MARS brings together the capacity to implement both the enhanced reporting requirements stipulated by the IPCC Good Practice Guidance and the UNFCCC guidelines adopted for reporting under the Convention (at COP9) and those required for reporting under the Kyoto Protocol (at COP10). Section 5.6 summarizes how Canada is preparing to meet the reporting requirements for supplementary information under Article 3, paragraphs 3 and 4 for LULUCF activities under the Protocol.

LULUCF MARS is managed by an interdepartmental Steering Committee chaired by EC and with representatives from the Research Branch of AAFC and NRCan-CFS. Three technical Working Groups address the sub-sectors of Forestry, Agriculture and Land-Use Change, respectively, as illustrated in Figure 3. They all coordinate the LULUCF activities of the three core federal departments and other relevant agencies and ensure that the best available information and data from scientific research, including from provincial/territorial governments and academia, are integrated into the LULUCF inventory.

Memoranda of Understanding were signed in 2004 between EC and the CFS and between EC and AAFC, by which the CFS annually develops and delivers forest-related GHG estimates of the LULUCF sector and AAFC develops cropland and grassland-related GHG estimates. Estimates have to be accompanied by complete and transparent documentation, including on uncertainty and quality control. The CFS has developed the National Forest Carbon Monitoring Accounting and Reporting System (NFC-MARS), and AAFC the Canadian Agricultural Greenhouse Gas – Monitoring, Accounting, and Reporting System (CanAg-MARS), both of which contributed major improvements to the national LULUCF inventory. EC develops estimates for other LULUCF categories, undertakes quality assurance and plays an integrating role, ensuring consistency in the land representation system.

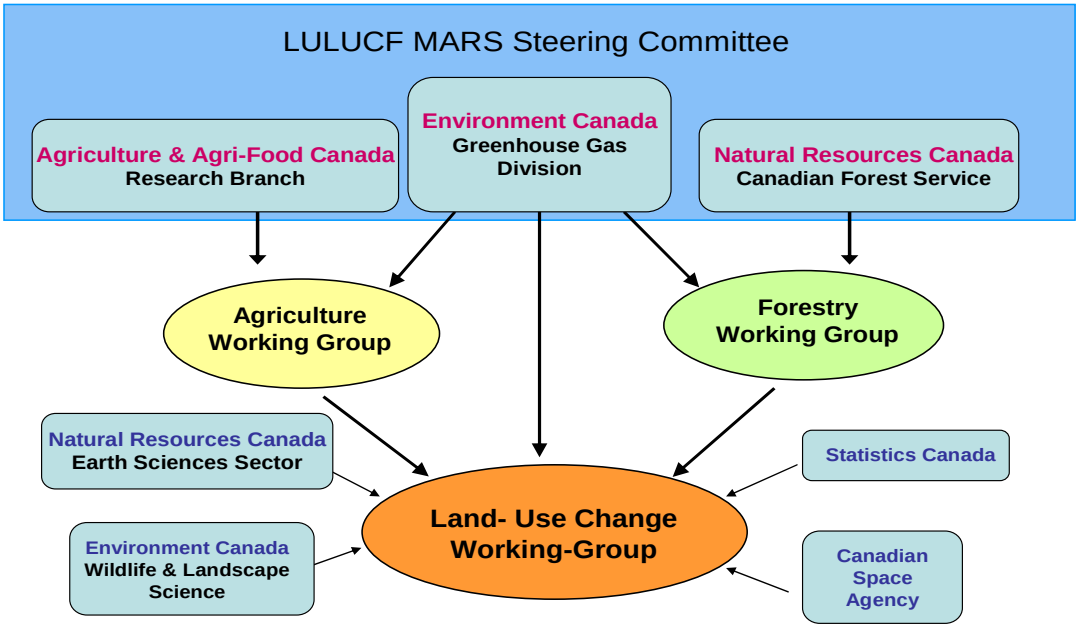

Figure 3: Arrangements in the Monitoring, Accounting & Reporting System for the Land Use, Land-Use Change & Forestry Sector of the National Inventory

Canadian Forest Service of NRCan

As mentioned above, the CFS developed and is maintaining the National Forest Carbon Monitoring Accounting and Reporting System which is a component of the *LULUCF MARS.* CFS is responsible for providing GHG estimates for forest land including deforestation, afforestation and managed forests. CFS is also coordinating the underlying research on forest ecosystems and chairing the National Forest Sinks Committee involving provincial and territorial representatives.

Agriculture and Agri-Food Canada

As previously indicated, AAFC developed and manages the CanAgMARS. In addition to its responsibility in the *LULUCF MARS* as per above (cropland and grassland), AAFC is also playing a major role in the agriculture sector inventory preparation in concert with EC, building on decades of research on carbon and nitrogen cycles and animal science in particular.

Transport Canada

Fleet fuel efficiency data is provided by the federal Transport department. Current plans aim at broadening and reinforcing its involvement.

Canadian Space Agency (CSA) and the Earth Science Sector (ESS) of Natural Resources Canada

These agencies contribute earth observation expertise and remote sensing data to the LULUCF MARS. CSA contributes funding to a multi agency project on land use and land cover monitoring. ESS is involved in the monitoring and estimation of some land use change in the arctic and sub-arctic regions of the country.

Department of Foreign Affairs and International Trade (DFAIT)

While DFAIT is Canada's official Focal Point to the UNFCCC, Environment Canada through the GHG Division has been designated the Inventory Agency and is responsible for submitting the National Inventory directly to the UNFCCC.

Provincial and Territorial Governments

Provincial and territorial governments are close partners of the GHG Division both on a bilateral basis and through the Emissions and Projection Working Group. Provinces and Territories are also working closely with the Canadian Forest Service as they are key forest inventory data providers, among others, to the National Forest Carbon component of the LULUCF MARS.

Consulting Groups and Academia

EC has had a long standing relationship with experts in various consulting firms and universities in Canada. Key academia examples include University Centres of Excellence and research scientists in the energy, agriculture, aquatics and waste related fields. When required, contracts are established with consultants or universities to conduct in-depth studies for example on updating emissions factors.

Industry and Industry Associations

The industry sector is a key partner in all sectors of the inventory, providing technical hands-on expertise and emission factors, activity data or GHG estimates. A bilateral agreement with the Aluminium Association of Canada is being signed by which they are to provide annually to Environment Canada process-related emissions estimates for CO_2, PFC and SF_6.

5.3 Process for Inventory preparation

5.3.1 National inventory estimation process

This section describes in general terms the annual inventory development cycle from the planning phase to the submission to the UNFCCC. The inventory schedule is built around a continuous process of methodological improvements, data collection, refinements and review, according to the quality management

and improvements plans. Figure 4 illustrates a typical cycle in the preparation of the Canadian inventory.

The Inventory Coordinator is responsible for preparing the inventory schedule, organizing the kick-off meeting and subsequent regular coordination meetings, linking with the QA/QC Coordinator and ensuring the inventory is developed according to schedule.

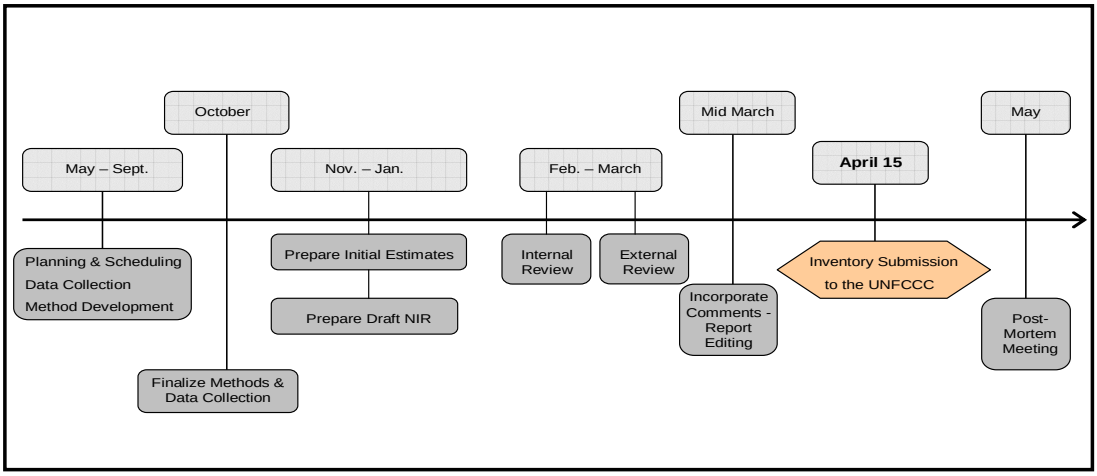

Figure 4: Typical Inventory Cycle

Based on the outcomes of the debrief from the previous inventory cycle, QA/QC follow ups, the UNFCCC review report and the improvement plan, methods are annually reviewed, developed and/or refined if necessary during the period from May to September; this process involves consultation with external experts and partners. During this time, the required data starts to be collected while the new inventory schedule is prepared and distributed. By the end of October, methodologies are finalized and the data collection process is almost complete. Data are collected either electronically or manually (hard copies) from data providers or publications, and are entered into spreadsheet-based emission estimating systems, databases or models and controlled for quality.

Between November and January, draft estimates and a national report are prepared by inventory experts. By 1 December, estimates and documentation are received from the Canadian Forest Service and Agriculture and Agri-Food Canada for their respective contribution to the LULUCF sector inventory. EC reviews this information and proceeds with quality checks before integrating it into the LULUCF sector estimates and in particular land use change categories. Emissions are calculated by inventory experts (dedicated to a specific sector); all text files and datasheets are signed-off by sectoral managers (see Figure 2)

before the NIR and CRF compilers prepare the report and national totals. As explained below, this process also implies key category assessment, recalculations, uncertainty work, QA/QC, and documentation preparation. Over the months of February and March, the compiled inventory is first reviewed internally, and components of it are externally reviewed by experts, government agencies and provincial/territorial governments, while the NIR is fully edited. Comments received are documented and incorporated in the final draft, after which, once the submission is approved by senior officials, both the NIR and CRF are submitted to the UNFCCC by April 15. The NIR is then translated into French and published both on the Environment Canada Web site and in hard copy. A CD containing both the NIR and the CRF is made available. A "*post mortem"* meeting is held both internally and with LULUCF MARS partners to discuss lessons learned and review the procedures in order to prepare the subsequent inventory plan and constantly improve the inventory process. To give due justice to the methodological complexity of the inventory, readers should realize that many improvements are developed and implemented over several years and are not strictly part of an annual cycle.

The NIR and CRF are developed in accordance with the UNFCCC Guidelines and the Revised 1996 IPCC Guidelines for National Inventories as well as the IPCC Good Practice Guidance (2000, 2003). The Canadian inventory is covering the full suite of anthropogenic sources and sinks of CO_2; CH_4; N_2O; HFCs; PFCs; and SF_6.

The NIR also contains (in Annex 15) a summary of emissions of Criteria Air Contaminants (except for LULUCF).

5.3.2 Process for collecting activity data and for selecting emission factors and methods

As mentioned, the inventory agency collects activity data from a variety of sources, including a large number of published sources. Using the IPCC Guidelines and Good Practice Guidance documents and other scientific and technical literature and reports, appropriate methodologies, emissions factors and other parameters are selected (and for some developed) by GHGD experts through expert judgement and in concert with partners, researchers and /or consultants through regular working groups meetings (as in the case of LULUCF and Agriculture), consultations, studies, reviews, quality assurance activities over specific sources/sink categories. Rationale and decisions made are documented, archived and periodically reviewed. Methods and factors used in the Canadian inventory are considered to be the best available to date, given the most current knowledge and available activity data. For the majority of sources, Tier 2 and Tier 3 country specific methods are used; because they better reflect national circumstances, they arrive at more accurate estimates of emissions and removals.

5.3.3 Process and results of key category identification

A key source or sink category is one that is prioritized within the national inventory system because its estimate has a significant influence on a country's inventory either from a level point of view or from a trend point of view, or both. Key categories can also be identified qualitatively for example if the corresponding sources and sinks are subject to mitigation techniques or in cases of a high anticipated growth or decrease. Key category analysis is required by the UNFCCC Guidelines and Good Practice Guidance and allows the prioritization of resources and efforts within the national system.

Each year, once the inventory is final, the Key Category Compiler performs a Tier 1 assessment. The top key categories identified on the 1990-2004 inventory submitted in 2006 based on the level and trend assessments (including LULUCF) are the fuel combustion categories (Road Transportation, Public Electricity and Heat Production, Other Sectors, and Manufacture of Solid Fuels and Other Energy Industries) and the LULUCF category Forest Land Remaining Forest Land. Details and results of the assessments are presented in Annex 1 of the 2006 National Inventory Report. Environment Canada is currently evaluating a Tier 2 identification whereby a categories' contribution to the overall emissions level and trend is weighted by the quantitative uncertainty estimate of each category. Key categories are given special attention with respect to QC and QA and, to the extent possible, country specific methodologies and emission factors (as opposed to default) are used for their estimation.

5.3.4 Process for the recalculation of inventory estimates

As part of the continuous improvement process, each year the Greenhouse Gas Division reviews and if necessary, revises and recalculates emissions and removals estimates for the whole inventory period from 1990 onwards, following the UNFCCC Guidelines and Good Practice Guidance. This important process not only guarantees that the most recent and "best available" GHG estimates are reported but also ensures consistency in the time series. Recalculations can be triggered by a change in methodology, emission factor or parameter, by an update in activity data or by the addition of a new category. Changes are identified by reviewers or inventory experts as a result of ongoing scientific advancements and improvements or the application of QA/QC procedures. These changes are anticipated early in the process and taken into account in the inventory planning. They are a natural consequence of the selection of appropriate methods and parameters, and the collection of activity data. When possible, Tier 2 quality control procedures are applied, in addition to Tier 1 checks, to those categories where significant changes occurred. Recalculated estimates for years previously reported are obtained from inventory experts and then compiled in the tables of the Common Reporting Format by the CRF compiler. At this stage, differences with the latest submitted estimates are also recorded in the Table 8 series of the CRF. Rationale for recalculation and

impacts on emission levels and trends are documented each year in Chapter 9 of the National Inventory Report.

5.3.5 Uncertainty analysis

The identification of sources of uncertainty and their quantification are of assistance in defining and prioritizing improvements to the national inventory. Canada's national system addresses the UNFCCC and GPG requirements to quantify and report uncertainty of emissions and removals estimates. The first uncertainty assessment was performed in 1994. A second one was undertaken in 2004-2005 on the GHG estimates reported in 2003 (1990-2001) using a Tier 2 method. Neither one included the LULUCF categories. The more recent study included an overall trend uncertainty. Updates to the uncertainty estimates such as in the agriculture and energy sectors were incorporated and reported in the NIR 2006. Results and details can be found in Annex 7 of the NIR.

For the time being, Environment Canada has to rely almost entirely on external consulting expertise except for the agriculture and LULUCF sectors where government research scientists have been involved. Assessing the combined and correlated uncertainties of spatial data and activity data remains a unique challenge. A mid-term goal, resources permitting, is to build the internal capacity with the inventory agency to perform uncertainty analysis through the development of an uncertainty quantification system (including tools and training), allowing updates to the uncertainty estimates as activity data, factors or methods change.

5.4 Quality Assurance and Quality Control

The planning, preparation and management functions assumed by the Greenhouse Gas Division all form part of the inventory Quality Management System that is gradually being implemented via a staged approach. The quality system strives to ensure that the required standards of transparency, consistency, comparability, completeness and accuracy are implemented at every stage of the inventory process. These UNFCCC principles provide the framework for the inventory agency and its partners throughout the complete system design and inventory process.

Informal QC has been performed regularly over the inventory, and a formal external review process has been in place for many years. The design of a formal QA/QC plan meeting the UNFCCC and IPCC Good Practice Guidance requirements was initiated with the development of a QA/QC framework in 2004. The plan, which is being built upon this framework, is an integrated and systematic approach to managing inventory quality, working towards continuously improved estimates of emissions and removals.

In 2006, the Greenhouse Gas Division appointed a QA/QC Coordinator with overall responsibility for the design and implementation of the full QA/QC plan. This includes the definition of quality objectives; coordination of quality control and assurance procedures; coordination of the processes governing expert review audit and verification; and upgrades and maintenance of the documentation and archiving system in accordance with agreed standards.

Coordination of QA/QC work is also done with outside agencies and organizations that provide activity data and/or developing actual GHG estimates for Environment Canada (e.g., Statistics Canada, LULUCF partners, industry, etc.). This work is undertaken in order to assess whether the QC and QA procedures in their respective data collection systems are in place or are being developed, implemented, documented and meet the minimum requirements of the QA/QC plan.

5.4.1 Quality Control Procedures

Quality Control (QC) is defined as a system of routine technical activities undertaken as the inventory is being developed that is designed to measure and control the quality of the inventory, to ensure data consistency, integrity, correctness, and completeness, and to identify and address errors and omissions. The scope of these activities covers a wide range of inventory processes, from data acquisition and handling and application of approved procedures and methods to calculation of estimates and documentation.

Documentation of QA/QC procedures is at the core of the system and uses several standard forms for the consistent and systematic recording of all QA/QC activities conducted in the annual inventory preparation. The QC forms include a record of any corrective action taken and refer to supporting documentation. These forms, or checklists, are completed during each annual inventory preparation, stored in “Activity Books” and archived along with other procedural and methodological documentation by inventory category and by submission year.

A series of systematic Tier 1 QC checks are performed annually to at least the key categories and across sectors by staff in the inventory agency. Tier 1 QC follows the Good Practice Guidance and consists of documented:

- Checks preventing easily avoidable data errors, e.g. during data flow, use of appropriate units, basic calculations;
- Checks of consistency among data used in multiple sectors;
- Checks on basic trends analysis, comparison with previous estimates;
- Checks that proper documentation: of assumptions, selection criteria for both EF and parameters, methodologies, expert credentials have been made; and
- Checks for completeness.

Checks on the documentation and archiving of all the information required to produce the national emissions estimates also form part of the plan, focussing on the key categories. In addition, formal cross-cutting QC checks on CRF and NIR assembly and final products were performed prior to the submission and documented.

Agriculture and Agri-Food Canada and the Canadian Forest Service, who develop some GHG estimates for the inventory, also undertake and document internal quality control on their estimation procedures, data systems and results that are complemented by checks by Environment Canada.

In addition to general Tier 1 QC checks, some Tier 2 QC are performed on a case-by-case basis starting with key categories (for which higher tier methodologies are typically used) and categories where a significant change in method or data occur. Tier 2 QC procedures are specific to the categories and require a more in-depth technical expertise. A schedule for systematic Tier 2 QC is under development.

5.4.2 Quality Assurance

Quality Assurance (QA) generally consists of independent third-party review activities to ensure that the inventory represents the best possible estimates of emissions and removals and to support the effectiveness of the QC program. Similar to Tier QC, quality assurance is undertaken every year on components of the inventory. Thus far, a formal provincial and territorial emissions experts' working group has annually reviewed the draft inventory. Sections are also reviewed at the same time by government experts and scientists of the national Monitoring Accounting and Reporting System for LULUCF.

In addition, selected underlying data and methods are independently assessed each year by various groups or individual experts in industry, academia and governments, in particular in the Energy and Industrial Processes sectors (e.g., aluminium, fugitives, etc.). Efforts need to continue to systematically track and document findings so that they can be effectively translated as required into the development of improvement plans.

QC and QA procedures will be fully developed and integrated into the plan in the form of a formal schedule of peer reviews, with a focus on category- or sector-specific reviews, as required. It is also planned that an audit will be conducted to objectively evaluate how effectively the national system and the general inventory process comply with the minimum specifications outlined in the Good Practice Guidance and the QA/QC plan.

5.4.3 Documentation and archiving

Transparency is a paramount quality goal of the national inventory and is a major focus of QA/QC development initiatives. Underlying data and studies, references, methodological documents, procedure manuals and system documentation, QA/QC procedures, GHG data, trends analysis and models and spreadsheets are archived electronically and for the narrative part, in hard copy.

The system is also designed so that access to all archived inventory information is open to UNFCCC expert review teams and auditors. One of the quality objectives of the national system is to respond in a timely manner to any enquiries emanating from them. As of the time of writing, a fully implemented system has yet to be completed and development is ongoing.

5.4.4 Management of confidential data

Canada's inventory agency has access to and handles confidential data, which is necessary to develop GHG estimates. Access to all databases and data exchange websites containing confidential data is restricted to authorized personnel. In order to meet the Government Security Policy requirements and safeguard the confidential information, additional procedures are currently being put in place, including the installation of authorized encryption software.

5.5 Procedures for the official consideration and approval of the inventory

Typically, the National Inventory Report is compiled annually by February and its contents are sent for review by a federal/provincial/territorial group of experts (the Emissions and Projections Working Group of the National Air Issues Committee). Once completed, the draft NIR and a summary of the data and trends analysis is prepared for sign-off for submission to the UNFCCC Secretariat. For the NIR submitted in 2006, approval to submit was delayed by a couple of weeks, with final approval granted by the Minister of Environment in early May. In the process of considering the national inventory and the results, several briefings of senior officials typically take place prior to the report being sent to the Minister. Once approved, the National Inventory Focal Point prepares a letter of submission to accompany the NIR and CRF tables which are then sent electronically.

5.6 Preparation for commitment period estimation and reporting of GHG from activities under Article 3, paragraph 3 and 4

Canada's new Monitoring Accounting and Reporting System (MARS) for Land-Use, Land Use Change and Forestry, led by EC, NRCan-CFS and AAFC as described above, has been designed, and is flexible enough, to meet the monitoring, accounting and reporting requirements of both the UNFCCC (LULUCF sector) and the Kyoto Protocol (LULUCF activities under Article 3.3

and 3.4). Its forest component, the National Forest Carbon MARS of NRCan-CFS, employs forest-inventory data, growth and yield information, and statistics on natural disturbances, management actions and land-use change to estimate changes in forest carbon stocks, and emissions of non-CO_2 greenhouse gases (Kurz et al., 2006[2]). Its agriculture component, the CanAgMARS of AAFC, is a soil carbon accounting system where the land areas affected by changes in cropland management practices are combined to carbon factors specific to each change in practice.

The LULUCF MARS system was implemented for the first time in the 2006 submission to the UNFCCC. The following is a description of how it will meet the requirements of both Article 3, paragraph 3 and of cropland management under Article 3.4, including the identification of lands according to decision 16/CMP.1.

Canada's system for monitoring and reporting Afforestation/Reforestation and Deforestation (ARD) activities under Article 3.3 and Cropland Management (CM) under Article 3.4 will emphasize consistency across the land category definitional framework and in the methods used to estimate carbon stock changes and greenhouse gas emissions, while abiding by the specific accounting requirements of the Kyoto Protocol. It will build entirely on the system currently used to report on Land Converted To Forest Lands, Conversion Of Forests and Cropland Remaining Cropland under the LULUCF sector.

5.6.1 Method for identification of lands

Land in Canada is stratified into a hierarchical system of nested ecological polygons where soil landscape polygons are the smallest units and ecozones the largest ones (Marshall and Schut, 1999[3]). As described in Canada's 2006 National Inventory Report, net emissions and removals from the LULUCF sector are already reported with reference to the boundaries of the terrestrial ecozones of the national ecostratification. The Common Reporting Format provides the geographical breakdown of LULUCF estimates by these zones. During the commitment period, lands under ARD and CM will be identified and GHG reported in the same way. The method used to identify the lands is the IPCC Good Practice Guidance's Method 1 (page 4.24, Section 4.2.2.2) by which multiple land units subject to ARD or CM are encompassed within established, geo-referenced boundaries (the ecozones).

[2] W.A. Kurz and M.J. Apps, 2006, Developing Canada's national forest carbon monitoring, accounting and reporting system to meet the reporting requirements of the Kyoto protocol. Mitigation and Adaptation Strategies for Global Change (2006) 11: 33–43, 2006.

[3] Marshall, I. B. and P. H. Schut. 1999 A National Ecological Framework for Canada. Ecosystems Science Directorate, Environment Canada and Research Branch, Agriculture and Agri-Food Canada.

5.6.2 Afforestation/Reforestation and Deforestation

In recent years, Canada has elaborated a completely new approach to monitor deforestation, compliant with the forest definition provided under section 3.1. It integrates remote sensing imagery, records, and expert judgment to capture the various forest conversion events and patterns since 1970.

Records of afforestation since 1990 were recently compiled and published by the Canadian Forest Service. A web-based National Afforestation Inventory was developed to monitor afforestation activities across the country and identify those qualifying for the UNFCCC and Kyoto Protocol land use framework.

Estimates of the immediate impact of deforestation are generated with the Carbon Budget Model of the Canadian Forest Sector version 3 (CBM-CFS3), a stand and landscape-level model of forest carbon dynamics that provides summary information on the five carbon stocks, stock changes, emissions and removals of carbon and non-CO_2 greenhouse gases and a variety of other indicators. The CBM-CFS3 tracks individual records containing forest areas, quantifies the carbon stocks of forest land converted to other land use to determine carbon stock changes and GHG emissions, and assigns them to the post-conversion land use (cropland, wetlands or settlements).

Emissions and removals from residual decay and the new land management activities on deforested and afforested lands are estimated within a consistent modeling framework in which ARD land areas are labeled by year of land-use change, allowing the separate tracking of emissions and removals on lands subject to ARD activities since 1 January, 1990. The modeling framework combines the outputs from the CBM-CFS3, the CanAgMARS modeling process for agricultural soils and Environment Canada's emission estimates from wetlands by carbon pool, land categories, and year of land-use change.

5.6.3 Cropland management

Cropland management is defined by decision 16/CMP.1 in paragraph 1(f) of the Annex as "*the system of practices on land on which agricultural crops are grown and on land that is set aside or temporarily not being used for crop production*". Canada has implemented the definition of cropland management as including all lands in annual crops, in summer-fallow, and in perennial crops (mostly forages but also including berries, grapes, nursery crops, and fruit tree orchards). Cropland management also includes pasture with the exception of natural land used for grazing in ecological areas where the vegetation would not eventually become forest if left unmanaged.

The implementation of cropland management will be as consistent as possible with the current reporting on the LULUCF sector category Cropland remaining

Cropland, the differences being the application of the Kyoto accounting rules, notably the separate tracking of forest lands converted to cropland since 1990.

6. Description of Canada's National Registry

Canada is committed to having an operational national registry in place for the first commitment period in 2008, and has taken a number of significant steps toward the establishment of its national registry under Article 7.4 of the Kyoto Protocol.

Since 2003 Canada has made a number of contributions totalling US$125,000 to the UNFCCC Trust Fund for Supplementary Activities, to help facilitate the work of the UNFCCC Secretariat on both the Data Exchange Standards and the implementation of the International Transaction Log.

In February 2004, Canada undertook the first phase of its procurement process for a national registry application through the issuance of a Request for Information to potential application providers. This process allowed for an analysis of options available.

Additionally, since 2003, Environment Canada has had the designation of interim Administrator of the National Registry and has participated in the UNFCCC Secretariat's regular inter-sessional consultations on Registry Systems and, more recently, the Registry System Administrators' forum.

Canada has also undertaken legal and policy analysis in preparation for the establishment of its registry. The analytical assessment has become a more comprehensive process because of the need to consider that Canada's registry or registries should have the capability of meeting possible domestic as well as international needs. While the necessity of considering the nature of domestic registry requirements has extended the time required for the analytical phase, significant progress has been made nonetheless.

Environment Canada is currently examining a series of options with respect to the selection of a national registry application. Subject to approval by the Government, the expectation is that a procurement process would be launched as soon as possible in 2007, with the goal of ensuring that the national registry is operational for the first commitment period in 2008. Work is also underway in parallel regarding the designation of Canada's National Registry Administrator.

Canada will provide complete information pertaining to its National Registry as required under the relevant Guidelines under Article 7.4 of the Kyoto Protocol and the Guidelines for Supplemental Information under Article 7.2 of the Kyoto Protocol as soon as it is possible to do so.

It is Canada's intention to provide this information in accordance with both the process and timelines contained in the Guidelines for Review under Article 8 of the Kyoto Protocol and through the Registry System Administrators (RSA) Forum's activities in regards to the initialization of Registry Systems with the International Transaction Log.