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Report of the technical assessment of the forest management reference level submission of Canada submitted in 2011

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Contents

I. Introduction and summary

A. Overview

1. This report covers the technical assessment (TA) of the submission of Canada on its forest management reference level (FMRL), submitted on 30 March 2011 in accordance with decision 2/CMP.6. The TA took place (as a centralized activity) from 23 to 27 May 2011 in Bonn, Germany, and was coordinated by the UNFCCC secretariat. The TA was conducted by the following team of nominated land use, land-use change and forestry experts from the UNFCCC roster of experts: Mr. Nagmeldin G. Elhassan (Sudan), Mr. Giacomo Grassi (European Union), Ms. Rehab Ahmed Hassan (Sudan), Mr. Vladimir Korotkov (Russian Federation), Mr. Rae-Hyun Kim (Republic of Korea), and Mr. Kevin Black (Ireland). Mr. Nagmeldin G. Elhassan and Mr. Giacomo Grassi acted as lead reviewers. The TA was coordinated by Ms. María José Sanz-Sánchez (UNFCCC secretariat).

2. In accordance with the "Guidelines for review of submissions of information on forest management reference levels" (decision 2/CMP.6, appendix II, part II), a draft version of this report was communicated to the Government of Canada, which provided comments that were considered and incorporated, as appropriate, into this final version of the report.

B. Proposed reference level

3. Canada has proposed two FMRLs, which were provided including harvested wood products (HWP), based on two options for estimating emissions from the historic pools. During the TA, in response to a request from the expert review team (ERT), Canada provided an additional reference level assuming instantaneous oxidation for HWP. All three levels include 12.5 million tonnes of carbon dioxide equivalent (Mt CO_2 eq) of background level for wildfires.

Table 1
Proposed reference level using different approaches for the pool of harvested wood products (Mt CO_2 eq per year)

HWP pool starts in 1900	*HWP pool starts in 1990*	*No HWP (instantaneous oxidation)*
–102.75	–114.30	–70.60

II. General description of the reference level

A. Overview

4. Canada opted to use a projected reference level calculated using CBM-CFS3 (Carbon Budget Model of the Canadian Forest Sector) based on an integrated forest inventory and yield curves with spatially-referenced activity data on forest management and natural disturbances.

B. How each element of footnote 1 to paragraph 4 of decision 2/CMP.6 was taken into account in the construction of the reference level

1. Historical data from greenhouse gas inventory submissions

5. The most recent national inventory report (NIR) data and historical data were those reported in the 2011 Canadian national greenhouse gas (GHG) inventory submission. Compared with the 2010 submission, the whole time series has been recalculated in the 2011 submission due to an update in the activity data for areas affected by wildfires and insects in 2009, and updated harvesting information.

2. Age-class structure

6. The age-class structure of Canada's managed forest land as presented in the Party's submission shows a 'right-handed' age-class structure, that is about 40 per cent of managed forests were over 100 years old in 2009.

3. The need to exclude removals from accounting in accordance with decision 16/CMP.1, paragraph 1

7. See paragraph 23, chapter E.7 below.

4. Other elements

Forest management activities already undertaken

8. Canada's submitted FMRLs included various harvesting methods (such as clear-cut, selection, salvage and shelterwood harvesting), as well as commercial thinning and slash-and-burn practices. However, other silvicultural activities (tree planting, fertilization and pre-commercial thinning) were not accounted for explicitly because these activities are rarely implemented (fertilization, pre-commercial thinning) or their impacts are accounted for implicitly in the growth and yield data used in CBM-CFS3.

Projected forest management activities under a 'business as usual' scenario

9. Canada's assumption that the average historical harvest during the period 1990–2009 will be maintained during the reference-level period implies that the historical forest management activities will continue in the period 2013–2020.

Continuity with the treatment of forest management in the first commitment period

10. Although Canada did not elect forest management for the first commitment period of the Kyoto Protocol, the approach, definitions, input data and assumptions used to construct the FMRL were consistent with the forest land remaining forest land category.

C. Pools and gases

1. Pools and gases included in the reference level

11. Canada's FMRL included the five standard carbon pools: above- and below-ground biomass, dead wood, litter and soil organic matter; and HWP. Non-CO_2 GHG emissions include methane and nitrous oxide from controlled burning activities performed after harvesting and from wild fires.

2. Consistency with inclusion of pools in the estimates

12. Canada has ensured consistency in the treatment of pools and gases with the national inventory report for 2011.

D. Approaches, methods and models used

1. Description

13. Canada applied model-based methodologies when preparing its national GHG inventory and calculating its FMRL. The estimates were based on NFCMARS (National Forest Carbon Monitoring, Accounting and Reporting System) including the CBM-CFS3 model with the same activity data and parameters on forest management with the exception of natural disturbances (fires and insect infestations). The expert review team identified significant changes in the FMRL value between the submission of December 2009 (–105.4 Mt CO_2 eq per year) and the present one (–70.6 Mt CO_2 eq per year). Both numbers assume instantaneous oxidation of HWP. The Party explained that the differences were due to a number of changes including the following:

(a) The recalculation of estimates and the addition of another year of data;

(b) The updating of historical natural disturbance and harvesting data, which resulted in changes in delayed emissions projected to occur in the period 2013–2020;

(c) An improved projection of 'business as usual' harvesting, which is now based on the average historical harvest during the period 1990–2009.

More detailed information provided by Canada during the TA on the factors that caused a change in FMRL is included in the annex below.

2. Transparency and consistency

14. Canada explained that its FMRL was derived from the assumption of a constant background level of natural disturbances (wild fires only). For the period 2013–2020, projections from Canada include large delayed emissions from all natural disturbances that occurred during the period 1990–2009. In response to a question from the ERT, Canada clarified that no additional area is assumed to be affected by insects for the period 2010–2020. In response to another question from the ERT, Canada stated that, due to the complex impact of disturbances on the dynamics of emissions and removals, it is not possible to reconstruct a time series starting from 1990, which may be meaningfully compared to the proposed FMRL.

15. Canada's submission and the replies that the ERT received to questions posed during the TA were transparent. The approach followed by Canada to calculate its FMRL is consistent with the information provided in the national GHG inventory.

E. Description of the construction of the reference levels

1. Area under forest management

16. Canada explained that the area under forest management is the same as the area of managed forest under the forest land remaining forest land category of the 2011 NIR.

2. Relationship of the forest land remaining forest land category with the forest management activity reported previously under the Convention and the Kyoto Protocol

17. The FMRL has the same area basis for forest management as was reported previously under the Convention and the Kyoto Protocol. In addition, the methodologies and corresponding data used for estimating emissions and removals for the forest land remaining forest land category were the same as those that have been applied for calculating the FMRL.

3. Forest characteristics

18. Canada's forest land covers 348 million ha including managed forests. The forestry under direct human influence extends over 229 million ha.

4. Historical and assumed harvesting rates

19. Canada provided projections of the harvesting rate (178.5 million m^3) for a 'business as usual' scenario for the period 2013–2020. This value is equal to the average of the harvesting data for the period 1990–2009.

5. Harvested wood products

20. In the projection of HWP, Canada provided FMRL for the treatment of HWP, following the approach proposed in Cancun, Mexico (FCCC/KP/AWG/2010/18/Add.1, paras. 27 and 28). This approach refers to three product categories (sawn wood; wood panels; and paper and paperboard). Canada, however, included also pulp[1] production under the category paper and paperboard. In response to a request from the ERT, Canada clarified that the pulp that it produces from domestic wood and exports should be included in the HWP emission estimates within the paper and paperboard category, and it corrected a minor technical error in the estimation of HWP emissions.

21. Canada provided a time series of historical and projected emissions from HWP for the period 1990–2020 using three approaches: instantaneous oxidation (submitted at the request of the ERT); the HWP pool starting in 1900; and the HWP pool starting in 1990.

6. Disturbances in the context of force majeure

22. The ERT noted that, in the submission by Canada and in the Party's responses to questions from the ERT, Canada did not provide an FMRL with and without disturbance due to force majeure. Canada has indicated that a constant 'background' level of natural disturbances is included in the reference level. However, in response to a question from the ERT, Canada has clarified that this background level includes only wild fires. Canada has explained that the effect of the background level of wild fires would cancel out when comparing the FMRL and the future reporting. Moreover, Canada clarified, in its FMRL submission, that it has been assumed that insect infestations will not affect any areas for the period 2010–2020. Additional information on delayed emissions provided by Canada during the TA is included in the annex below.

7. Factoring out

23. The putative impacts of elevated CO_2 concentrations above pre-industrial levels and indirect nitrogen deposition were not addressed explicitly in the construction of the

[1] Pulp refers to fibrous material prepared from pulpwood, wood chips, particles or residues by mechanical and/or chemical process for further manufacture into paper, paperboards, fibreboard or other cellulose products.

reference level for Canada, and will not be addressed explicitly in the estimates of emissions and removals for the period 2013–2020 during the accounting. However, to the extent that elevated CO_2 concentrations and N deposition have affected forest growth and are reflected in forest growth and yield data, the CBM-CFS3 captures these effects in both the reference level and the inventory estimates of actual emissions and removals. As a result, the effects will be factored out of the accounting.

F. Policies included

1. Description of policies

24. Canada explained that its FMRL reflects only harvest policies that were adopted and implemented prior to 2010. Assuming that the average historical harvest in the period 1990–2009 will be maintained during the reference level period, this means that only the effect of historical forest management policies is captured in the reference level. No detailed information on forest management policies was provided, the only references given were to policies adopted by provincial government agencies.

2. How policies are taken into account in the construction of the reference level

25. Canada's submitted FMRL reflects only implemented policies prior to 2010. New or changed policies and the related level of 'business as usual' emissions and removals, adopted and implemented after December 2009, have not been taken into account.

III. Conclusions and recommendations

26. Canada has calculated its FMRL on a transparent basis.

27. An FMRL taking into account force majeure disturbances was not included in the FMRL submission. Canada explained that it did not provide this information because the definition of 'force majeure' has yet to be agreed. The ERT noted Canada's explanation that its inability to provide an FMRL including 'force majeure' emissions reflects the fact that the threshold value for 'force majeure' emissions has not yet been agreed upon, and its concern that use of an FMRL that includes 'force majeure' emissions could result in undeserved credits.[2]

28. In response to a request for a detailed explanation of delayed emissions raised by the ERT during the centralized review, Canada provided additional information (see annex below) including examples of delayed emissions and reduced removals, and scenario analyses providing an indication of the order of magnitude of the impact on Canada's FMRL of delayed emissions and reduced removals due to insects.

29. In response to a request from the ERT, Canada provided additional information on the changes between the proposed FMRL (–105 Mt CO_2 eq per year) in its submission of December 2009 and the new estimate of FMRL using instantaneous oxidation of HWP (–70.6 Mt CO_2 eq per year) in several important ways. Four key elements explain the 34.8 Mt CO_2 eq per year difference between these two estimates, which are the following: increased harvest emissions (13.9 Mt CO_2 eq per year); reduced growth removals (17.9 Mt CO_2 eq per year); increased decomposition emissions (2.8 Mt CO_2 eq per year); and increased

[2] As explained by Canada, this would occur if, due to natural variability, the actual natural disturbance emissions during the accounting period are lower than the 'force majeure' emissions included in the FMRL.

background fire emissions (0.2 Mt CO_2 eq per year). The second part of the annex below contains the full explanation provided by Canada.

30. In response to an ERT recommendation, Canada clarified the treatment of market pulp in its HWP emission estimates and provided revised FMRL values for table 1 of its submission of –102.75 Mt CO_2 eq per year and –114.30 Mt CO_2 eq per year for the HWP pool starting in 1900 and 1990 respectively, amounting to a reduction of 0.06 Mt CO_2 eq per year from the originally proposed values.

Annex

Documents and information used during the technical assessment

A. Reference documents

Submission by the Government of Canada on the forest management reference level, 30 March 2011. Available at <http://unfccc.int/files/meetings/ad_hoc_working_groups/kp/application/pdf/canada_frml_en.pdf>.

National greenhouse gas inventory of Canada submitted in 2010. Available at <http://unfccc.int/5270.php>.

National greenhouse gas inventory of Canada submitted in 2011. Available at <http://unfccc.int/5888.php>.

FCCC/ARR/2010/CAN. Report of the individual review of the greenhouse gas inventory of Canada submitted in 2010. Available at <http://unfccc.int/resource/docs/2011/arr/can.pdf>.

Kurz, W.A., Dymond, C.C., Stinson, G., Rampley, G.J., Neilson, E.T., Carroll, A.L., Ebata, T. and Safranyik, L. 2008. Mountain pine beetle and forest carbon feedback to climate change. *Nature* 452: pp. 987–990.

FCCC/KP/AWG/2010/18/Add.1. Report of the Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol on its fifteenth session, held in Cancun from 29 November to 10 December 2010. Available at <http://unfccc.int/resource/docs/2010/awg15/eng/18a01.pdf>.

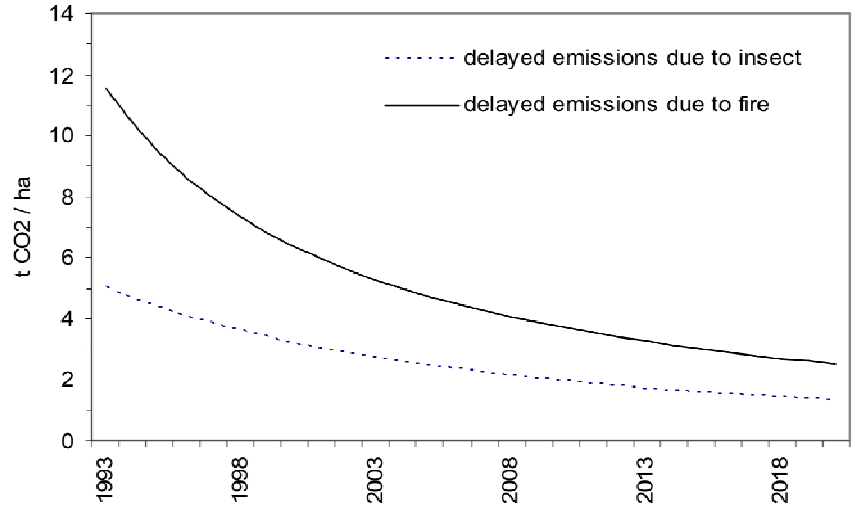
B. Additional information provided by the Party[1]

Delayed emissions

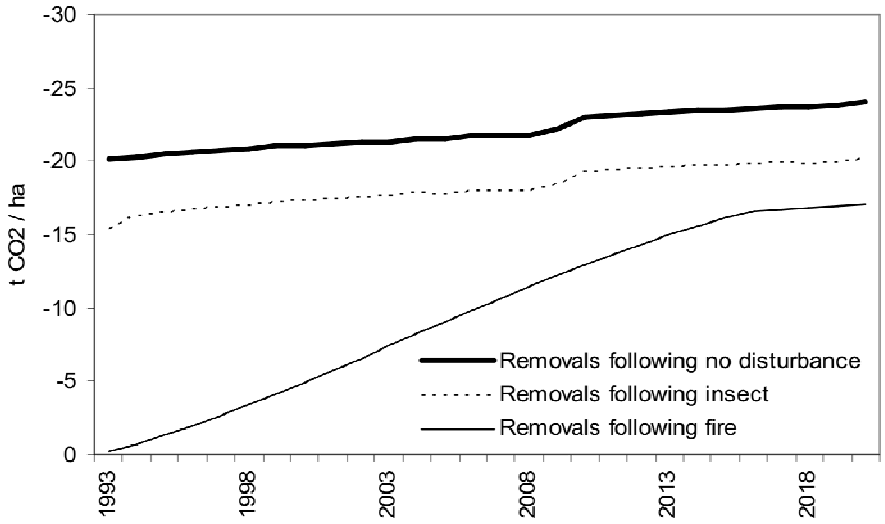
In response to a request by the expert review team (ERT) during the technical assessment (TA), Canada provided the following additional information:

Fire and insect infestations cause delayed emissions as a result of the decay of killed biomass and also cause reduced removals for a period as the affected forests recover from disturbance. Delayed emissions and reduced removals during 2013-2020 due to past fire and insects are included in Canada's FMRL. Delayed emissions occur over a period of several decades in disturbed Canadian forest stands and decline slowly over time. To illustrate this, the graph below provides an example of delayed emissions (t CO2/ha) from a stand disturbed by insects (assuming 50% tree mortality) and a similar stand disturbed by fire (assuming 100% tree mortality) in 1993.

[1] Reproduced as received from the Party.



Removals following fire and insect disturbance are noticeably reduced for several decades when compared with removals in similar but undisturbed stands. Below we provide an example of removals (t CO2/ha) by stands disturbed by fire and insects in 1993, to show how these are reduced relative to a similar, undisturbed stand. Although removals are lower following disturbance for the first few decades, eventually they recover to pre-disturbance levels and can even exceed removals by non-disturbed stands under some circumstances (e.g. disturbance of old stands that had small annual removals prior to disturbance).



Canada's methodology in CBM-CFS3 for calculating delayed emissions considers multiple dead organic matter pools with differing decay rates2, but does not keep track of the disturbance or other ecological processes that caused each unit of carbon to enter the dead organic matter pools. It is therefore not possible to isolate the portion of total ecosystem delayed (i.e. decomposition) emissions in Canada's FMRL for 2013-2020 thatis due to one

[2] Kurz et al. (2009), Ecological Modelling, 220:480-504 for a full description of the Carbon Budget Model of the Canadian Forest Sector, which was used by Canada to calculate its FMRL.

historical disturbance type versus another, or to non-disturbance litterfall, natural biomass mortality, or pre-1990 disturbance. Similarly, it is not possible to isolate the impact on removals in affected stands.

However, scenario analyses conducted previously using the CBM-CFS3 examined the impact of the mountain pine beetle and made projections through 20203. The mountain pine beetle outbreak was Canada's largest insect disturbance during 1990- 2009. Its impact on forest carbon was estimated to have peaked at a net emission of 74.5 Mt CO2 in 2009, but the combined impact of delayed emissions and altered removals was projected to remain high throughout 2013-2020 as shown in the table below. These net estimates provide an indication of the order of magnitude of the impact on Canada's FMRL of delayed emissions and reduced removals due to insects.

Year	2013	2014	2015	2016	2017	2018	2019	2020
Mt CO_2 / yr	62.9	58.7	55.7	52.6	50.8	48.1	46.2	44.1

Change of FMRL from December 2009 to March 2011

In response to a request by the ERT during the TA, Canada provided the following additional information.

Canada's proposed FMRL (-105.4 Mt CO2e/yr) in its submission of December 2009 and the new estimate for forest management using instantaneous oxidation of HWPs (-70.6 Mt CO2e/yr) provide to the ERT differ in several important ways. Four key elements explain the 34.8 Mt CO2e/yr difference between these two estimates, as shown in the table below.

Difference (Mt CO_2e/yr)	Percent of total difference	Cause of difference
13.9	40.0%	Increased harvest emissions (instantaneous oxidation)
17.9	51.4%	Reduced growth removals
2.8	8.2%	Increased decomposition emissions
0.2	0.5%	Increased background fire emissions
34.8	100.0%	Total

Increased harvest emissions: The projected harvest level for 2013-2020 (described in paragraph 30 and Figure 2 of Canada's March 2011 submission) is almost 10 million m3/yr higher than the projection used in the December 2009 submission. This change results from an improved projection approach, one that is consistent with historical data and ensures that only historical forest management policies are reflected in the projection. The higher harvest level results in 13.9 Mt CO2e/yr more emissions.

[3] See Kurz et al. (2008), *Nature*, 452:987-990 for a full description of the estimated impact of the mountain pine beetle outbreak on forest carbon in British Columbia, including delayed emissions and altered removals.

Reduced growth removals: Updates to natural disturbance monitoring data mean that the new estimate includes the impacts of more historic fire and insect infestations. One of the impacts of disturbance is reduced growth by affected forests as these recover from disturbance, as explained above. The total area disturbed by fire 1990-2008 used in the December 2009 submission was 12.5 million ha whereas the total area disturbed by fire 1990-2009 used for the new estimate is 12.9 million ha. The total area disturbed by insects 1990-2008 used in the December 2009 submission was 53.2 million ha whereas the total area disturbed by insects 1990-2009 used for the new estimate is 55.0 million ha. This means that an additional 2.2 million ha are modelled with reduced growth for the new estimate. As well, the new estimate includes more projected harvest, resulting in 0.8 million ha additional area harvested during 2013-2020, with associated reductions in removals by these lands following harvest. The reduced growth resulting from these changes causes 17.9 Mt CO2/yr lower removals than previously estimated.

Increased decomposition emissions: The updates to natural disturbance monitoring data and changes to harvest projections, as described in the two preceding paragraphs, also cause decomposition emissions during 2013-2020 to be higher than previously estimated. Delayed emissions due to the decay of larger estimated quantities of biomass killed by disturbance 1990-2009 and larger quantities of harvest residue generated during 2013-2020 cause overall decomposition emissions to be 2.8 Mt CO2/yr higher than previously estimated.

Increased background fire emissions: Recalibration of the CBM-CFS3 undertaken after the December 2009 submission resulted in new estimated background fire emissions. Calculations undertaken for the December 2009 submission had indicated that immediate emissions resulting from fires average 130 t CO2e per hectare burned. New fire impact data indicate that the immediate emissions average 132 t CO2e per hectare burned. When the increase in fire impact of 2 t CO2e per hectare is applied to the 95,000 ha/yr background fire level, the background fire emissions are 0.2 Mt CO2e/yr higher than previously estimated.